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AMERICAN REPERTORY

OF

MECHANICAL AND PHYSICAL SCIENCE,

CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,

AND OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED

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JANUARY, 1845.

CIVIL ENGINEERING.

Observations on the Adaptation of Public Buildings to the propagation of Sound, consistently with Speech. By Wm. Shand, Esq.

The following short observations are intended to show by practical illustration, the difficulties that have been experienced in regard to the economy of speech in apartments, and also the rules and means by which this may be effected.

General Remarks.—It is remarkable with what devoted assiduity men of science apply themselves to discover the cause of some peculiar phenomenon in nature, which, to many, appears of little importance, and may, by the rudest mechanic, be practically exhibited when the principles, or laws, by which it is produced are understood. When it was discovered that the electric fluid acted by the external surfaces only of conducting bodies, to a superficial observer it seemed of little consequence, but much time and many experiments were necessary to determine this.

When Sir Humphrey Davy discovered what led to the formation of the safety lamp, it appeared a trifling matter, but it cost this distinguished man of science much time and labor. The telescope, which brings so many distant worlds into view, is formed of bodies possessed of two simple properties—the opaque and pellucid—all else is artificial arrangement; and when optics was in its infancy, could it have been anticipated that this science would have been brought to such a height of perfection, and that many educated and able men would devote themselves solely to one department of it?

Much has been effected in the economy of heat, but it is applicable in such a variety of ways, and to so many purposes, that although much of utility is known, probably still more remains to be understood.

Difficulties in copying an erection consistently with Acoustic Principles.—The most subtle and abstruse phenomenon in the whole range of physical science is sound, which has hitherto been an *ignis fatuus.* In the very limited space of a common apartment, individuals are seen opening their mouths, stretching their necks, and putting the hand to the ear in order to catch that which is not, a false sound being to the ear what occular deception is to the eye. All men fancy it to be within their reach—of this various instances are at present exhibited; and these remind us of a circumstance, related by several authorities, of some Jesuits who erected a building in imitation of one near Milan, where the sound of a pistol shot is repeated upwards of forty times, but although the copy was in appearance the same as the original, yet it was without an echo.

Desertion of Principles in copying Canon Mills, Edinburgh.—Canon Mills, (a place intended for the preparation of gas,) where the first General Assembly of the Free church of Scotland met, is now considered a model for the economy of speech; and several places of worship have been erected as true acoustic copies of this edifice, which consists of, in part, an earthen floor, walls of rough, solid masonry, and slates as they came from the quarry, affixed to wood as it left the saw, all being single, compact materials, with rugged exteriors, having little vibratory action, or sound, *the solidity of the bodies, and roughness of the surfaces,* being the principles that are favorable to articulation by producing limited *undulations;* but the rough surfaces occasion harsh sound on the ear, in the ratio of their proximity to it.

In the copies from the original, instead of being partly earth, the floor is all boarded, and hollow under, giving out much extraneous sound from the action of the feet, and other causes. The walls, instead of being solid and rough, are lined with lath and plaster, hollow between, and smooth on the exterior, consequently having comparatively much more action and sound than the original; while the roof is lined with lath and plaster, in like manner as the walls; not anything being retained in the copies consistent with the properties of Canon Mills, except the general form, which is bad. All this deviation from the original seems strange, when it is considered that not a single atom in a sonorous body can be added, or displaced, without influencing sound. It is also remarkable that an old building, intended for so foreign a purpose, and so rude, should be found more demonstrative of the economy of speech than all the works of art that have been intended for this purpose.

Instance of the class-room of a man of science, formed of similar materials, and producing similar effects as in Canon Mills.—I shall now give another instance of rude and rugged materials producing similar effects, from similar causes, by moderation of action and sound. A celebrated physiologist, in his examination before the last Committee of the Commons, on the transmission of sound in apartments, &c., alludes to a particular class room, as constructed on scientific principles, and well adapted to the purposes of speech. In it the floor is of earth, the walls of solid and rough masonry, the roof is of unplaned plank, covered above with a thick coat of compost, and supported in the central parts by pillars of brick, in their original porous state: all being comparatively solid, and rough on their exteriors. The only material difference that I can perceive, is, that the old gas house, Canon Mills, is a matter of chance in regard to sound; whereas the learned doctor's class room has been constructed by a man of science; they are indeed very different in form, and yet form is the only point that architects seem to consider of importance in imitating Canon Mills. One advantage in both these places is, that *there is little glass exposed to the voice of a speaker.*

The materials used in Canon Mills, the physiologist's class room, the meanest cottage, or even the barn, are alike.

Erroneous to suppose that Undulatory Action should be lengthened, and Reflections prolonged.—The learned doctor, in his further depositions, recommends that the reflections of speech, in the Houses of Parliament, should be taken from the ceilings, transversely to the direction in which the human voice proceeds from the mouth; *the direction being horizontal whether we sit, or stand.* He also advises that the ceilings should be formed on the principles of a piano forte sounding board; thus increasing and prolonging sound, and the reflection of each letter more decidedly than the copyists of Canon Mills.

It may now be proper to ascertain by what means the principles by which the reflecting bodies, in these two apartments, are less ungenial to articulation, than where such are more sonorous and refined in appearance, as this may lead to the beneficial use of materials possessing similar properties, but less offensive to the eye.

Reasons why Speech is less indistinct in Canon Mills and the physiologist's class room than in more refined apartments.—Doctor Neil Arnot remarks, that when sound is reflected by a solid, the angle of incidence and reflection correspond; and he illustrates this by a boy's hand ball thrown against a wall, when the angle of reflection is equal to that of incidence. But the analogy applies only in a limited degree, because the ball is kept together in mass, whereas, the component parts of the atmosphere are scattered and divided, and so is sound, as our sense of hearing tells us. The greatest repelling force is, no doubt, in one direction, but the matter that gives effect to sound passes, in a certain degree, in all directions; the particles in the atmosphere impinging on a rough surface, press in various directions, in conformity to the minute angles presented to them, and consequently occasion less vibratory and undulatory action in the reflecting body than when the surface is smooth, and the pressure in one general direction. The component parts of the atmosphere thus recoiling in various directions, strike upon, oppose each other, and from this cause also lessen the sound. If the ear be near to such rough surfaces, they occasion harsh sound to be transmitted to the nerve of hearing; but at a little distance, the atmosphere again runs smooth, and produces no such effects.

I would next observe, as to the earthen floor, that the action and sound from it are much less than from hollow boarding;—the earth is comparatively soft, little elastic, and rough externally—for these reasons, sound from it does not sensibly affect the ear, nor cause any reaction from the roof. These facts may be learned from the ground in general producing no confusion either in speech, or music. The earth has also an action different from hard bodies of limited thickness, such as boards, lath, and plaster, by which motion and sound are lessened in these materials.

Angular Surfaces calculated to prevent extraneous sounds from reaching the ear.—The apartments just alluded to, are, I conceive, better calculated to demonstrate, by the rough surface and comparative solidity, the means by which harsh and ungenial reflections may be prevented from reaching the ear, than to exemplify the manner in which consistent reflections are to be obtained.

Instances of extreme confusion, prevailing for years, without any attempt to remedy this.—In order further to point out the difficulties that have been experienced in forming, and in copying rooms intended for speech, I would refer to my pamphlet on the Economy of Speech in Apartments, in which instances are pointed out, in various localities, where utter confusion prevails. Two very remarkable instances are, the church in Edinburgh, in which the General Assembly of the Church of Scotland met several years ago, but which they were compelled to desert, because they could not understand each other; there is great confusion throughout, and two of the galleries have ever since been locked up; nor has any attempt been made, so far as I know, to reclaim these. The other is St. Luke's Church in Liverpool, where the patrons have been rolling the incumbent from place to place, for a series of years, in a locomotive pulpit, with a drum canopy over it, thus increasing the evil wherever they go, instead of remedying it. If the matter be simple, as many say, why has not speech been rendered intelligible in these two edifices?

Sound reflected from Sonorous Solids in Apartments, in at least six directions, must necessarily confuse Speech.—It may be remarked that an apartment for speech being a work of art, in which solids are in a limited space, and most of them sonorous, when from the human voice, or any other cause, sound is produced by rapidly agitating the atmosphere, it impinges on, and recoils from, the sonorous solids, on the walls, the floor, and the ceiling, in at least six different directions; and if the agitation be great, the effects are similar to what is produced in the ocean, when waves meet from various directions in a small compass, occasioning, by their conflict, confusion in sound, as it has already done in the atmosphere, by which it is conducted.

There are various ways of exemplifying this in apartments, and in the atmosphere, where sound is not confined.

All Curvatures, by concentration, confuse Speech.—Notwithstanding that all writers on this subject, so far as I have been able to ascertain, recommend excess of sound, and several advise its concentration, or being made to act in foci, wherever the human voice, in speech, acts within a curvature, articulation is deranged, and the greater the curve, and the more sonorous the material, the greater is the perturbation.

The evil of extreme agitation, by changing the original character of sound, is exemplified in that of a bell, the sound of which is most clearly, intensely, and distantly heard, when there is an extremely light current of air moving from the bell towards the ear; but if the wind be strong, the component parts of the air are deranged, and sound is not heard so intensely, distinctly, or distantly.

Sonorous Solids conduct Sounds generally with velocity and intensity in a similar ratio, but in air it is equal in Velocity and Character throughout.—Sonorous solids are considered to conduct sound with velocity, much in the ratio of the intensity with which it is produced—concrete plaster 11 or 12 times, and glass and fir wood with 15 or 16 times its velocity in common air. In the atmosphere it passes with equal velocity in all directions, if no more dense medium should intervene between the source of sound and the ear, and it is *conducted without change of character.* In solids, its character and direction are changed, and the degree of sound depends on the density of atoms, and their distance from each other. When sound reaches a solid, its direction and character are changed, from various causes, according to the nature and form of the solid. It is produced by cohesion, repulsion, and friction in the atoms, and the degree of sound is, therefore, in a great measure, dependent on the density of the atoms, and their distance from each other; thus, silver and gold are less sonorous than copper, bell metal, or glass; and lead, which is peculiarly soft, is less sonorous than any of these bodies.

Sound acts similarly in the Musical String, and in Wood of long fibre.—There are other properties and arrangements in certain materials, which appear to operate, by their cohesive and repulsive principles, most powerfully in one direction; for instance, in wood of long fibre *it acts predominantly in the direction of the fibre, similarly to that in the musical string.*

Not only do these circumstances lead to a knowledge of the degree and character of sound emitted from various bodies, and tell us that every atom acts its part in producing it; but an understanding of all these points is necessary for the control and guidance of this singular phenomenon.

Sound being produced in Solids, acts throughout all their atoms.—On striking a solid, so as to produce sound, every atom in it is set in motion, and if another sonorous solid be in contact with it, similar effects are produced in the second as in the first solid, until by friction the atoms are brought to rest, when sound also ceases.

Predominating influence in the solids, but air also necessary to produce Sound.—For the reasons given, in the solids* usual in apartments, sound operates with more intensity and rapidity than in the atmosphere alone, (although the solid must be in contact with air,) but the predominating influence is in the solids.

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* Professor Liebig says, that every atom in the earth has its own atmosphere, and every

It is evident, from these and other understood facts, that it is in the solids in and surrounding an apartment, that sound must be regulated.

Cross Sounds not admissible, &c. Necessity of regulating Undulation in the solids.—I have already explained that neither cross sounds, nor excessive sound, is admissible, and that reflections which reach the ear must fall on the pinna horizontally—that the undulatory motion in the reflecting bodies must be regulated; and I shall further demonstrate the means by which this is to be effected, and those by which cross sounds are to be withheld from the ear, without exposing soft non-sonorous materials, so as to arrest the tremulous atmosphere and sound generally in an apartment. I have certainly explained enough to convince the most sceptical that it is preposterous to imagine that all that is requisite to be attended to is the mere form of a room, or that materials may be thrown together indiscriminately, conducting and reflecting in various directions, and in any degree. As sound passes with equal velocity in all directions in the atmosphere, the first solid that the voice of a speaker must operate on, is that nearest to him, and, being conducted with so much greater rapidity by the solids than in air, it must pass by the solids, and by these be given out to the atmosphere.

Effects of the predominating velocity and intensity of Action and Sound in the Solids.—For instance, supposing an apartment eighty-five feet in length, and half this width, and that the speaker is placed in one end against the wall, the sound of his voice passes by the atoms of the solids in the walls to the other end of the room, when it is only a few feet from his mouth in air, and as *undulation succeeds undulation* with so much greater rapidity and intensity of effect in the solids than in air, the predominating influence must be in the solids.

Prevention of Echo insufficient to economize Speech.—Many suppose that preventing echo and a repetition of reflection is sufficient; but this is only a palliation of the evils experienced, because a single reflection, although it may be prolonged too much, is less prejudicial than a repetition of reflection.

For the reasons given, irregular reflections of the voice and extraneous sounds are so general, that, although the ear may not be sensible of these individually, they interfere more than we are aware with those which convey distinct and intelligible sounds to the nerve and sense of hearing.

Further general observations.—In different phenomena, causes and effects vary; but, reasoning by analogy between hearing and sight, I would remark, in regard to the faculty of vision, that, if the

atom in the finest metal must have its own atmosphere to produce sound. He also remarks, that cork and India rubber have done more than any thing else, in the course of the last fifty years, for the improvement of chemistry; and such bodies as these, buff leather and woolen cloth, may do much for the economy of sound.

eye be directed to two objects at the same time, perception is less in both than if concentrated on one object. Are not cross lights, or rays, approaching the eye in transverse directions prejudicial? and shall sound, without measure, or adjustment, be communicated to the ear with impunity?

Reasoning further by analogy, the question may be asked, how are such effects produced in Newmachar Church, as are pointed out by those who have preached in it? Does not the soft, absorbent material (as it is termed) diminish sound as much as any thing that we know?—and yet they say that they were heard distinctly at any natural pitch of their voice in all directions, and they believe that similar principles and arrangements may be adopted in apartments of any extent with advantage.

The circumstance alone of speaking without oppression, and with ease in all places where the soft material has been used, is, of itself, very important, as many say they would rather speak a whole day in one place, than two hours in another place. The following hypothesis I believe to be applicable in this case:—

If several musical instruments are in tune, and operating in concert, the ear receives their sounds from a distance as of one instrument; but if any instrument gives out discordant sounds, this tends to overcome the more musical sounds, and derange the whole. Precisely such are the effects produced by reflected sounds from the solids in an apartment; in the one case, they give consistent strength and effect to each other, but in the other case they produce discord. If in a room certain of the walls are of solid masonry, and others of lath and plaster, and the ceiling is on the principles of a piano forte sounding board, all having different degrees of action and sound operating in opposition to each other, is it possible that there can be any accordance in the sonorous effects? Causes and effects are in this case similar to that of a complicated piece of mechanism, in which the parts do not fit and move together, but oppose each other; for sound is entirely the offspring of mechanical action in the matter which produces, or conducts, it.

Mode of Regulating Reflected Sounds intended to reach the ear.—The chief objects in the arrangements alluded to, are to obtain reflected sounds of the voice in speech from vertical bodies, so that they may be delivered horizontally on the pinna of the ear, being obviously the direction in which this expanded vibrating lever is best calculated to receive these.

All such reflected sounds must be regulated by the undulatory action in the reflecting solid, each undulation being made to conform in time and duration of sound, as nearly as may be, to the motion of the mechanism of the mouth in the formation of every distinct letter; and these reflections must not be so excessive as to produce any sensible reflection, or echo, from an opposite solid. To effect these objects, soft non-sonorous material is placed behind, and on the edges of the reflecting sonorous bodies, according to circumstances, so as to moderate the reflections, *and shorten the undulations.*

Nature points out that the reflected sounds of the voice should fall on the ear in a horizontal direction, because the voice proceeds from the mouth in this direction whether we sit, or stand, and, because all cross action in the atmosphere differing from this, is found prejudicial.

Means for Preventing Irregular Sounds from reaching the ear, &c.—In order to prevent cross action and derangement in the sonorous atmosphere, and in speech, and to keep extraneous sounds from the ear, a greater proportion of soft non-sonorous material must be placed on the unexposed parts of the ceiling, and on all sonorous bodies that do not reflect horizontally; but this soft non-elastic material must not be exposed to the atmosphere, or the direct action of the voice, except on the floor, because in this case it damps the sound of the voice too much throughout an apartment.* Extraneous sounds may also be operated on by means of rough, or angular, surfaces, so as to cause the particles in the atmosphere to act in opposition to each other, in order to break and divide sound, and thus prevent it from reaching the ear. Nature exhibits to us the surface of the ground always in a rough state, so as to prevent any moderate degree of sound, such as emanates from the human voice, from occasioning confusion, because the reflections do not reach the ear.

Note.—Lath and plaster are not the most desirable materials for the lining of an apartment; and, in the two Aberdeen churches, the windows are injudiciously and prejudicially placed without sufficient means being adopted to keep back from the ear the intense and irregular sound given out by the glass.

Glasgow Mech. & Eng. Mag.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Breast Water-Wheels.

In the year 1833, at page 6, vol. xi, of this Journal, we published an elaborate and able series of experiments, made by Ithamar A. Beard, on the *Breast Water-Wheels*, driving one of the Hamilton mills, at Lowell, Massachusetts. There were three water-wheels in this mill, each thirteen feet in diameter, and fourteen feet long in the bucket, or having forty-two lineal feet of bucket in all—their tops being level with the surface of water in the head race.

The water was drawn upon each of the water-wheels, during these experiments, by two gates, the upper drawing under a head of about *one foot*, and the lower drawing under a head of about *two feet*, so that, although called *breast wheels*, the water was let on so much above the centre, as probably to render the name of *pitch back overshots* more properly applicable to them.

The careful experiments above referred to, *show that these wheels realized a coefficient of effect of* .6049.

Conformably to this result, *about sixty per cent.* has usually been regarded as the coefficient of effect in breast water-wheels of this class, whilst those which draw on their water lower, have been thought even less efficient; but some experiments recently made upon the continent of Europe, develope the singular result, that when nicely constructed, *simple breast water-wheels may realize a coefficient of effect of more than eighty per cent!*

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* By the expansion of air in a room, it ascends, and sound with it, acting predominantly on the roof, and little on the floor; soft material may, therefore, be placed on the floor in order to annihilate sound from the feet, &c., without injury to the voice of a speaker.

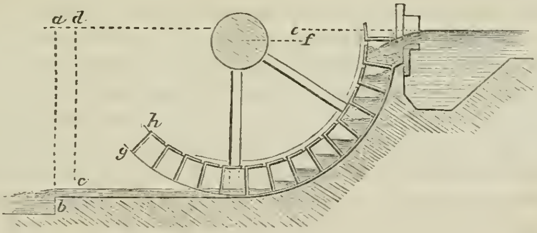
In other words, that a common breast water-wheel actuated by a fall of water of only about two and three-fourths metres, or nine feet, was, in the case referred to, *fully equal in effective power to any over-shot water-wheel!*

This being a result equally singular and interesting, we have translated below the experiments which develope it.

Com. Pub.

Notes on a Water-Wheel established in a Bleachery at St. Amarin. By M. Marozeau, *of Wesserling.—Translated for the Journal of the Franklin Institute, from the "Bulletin de la Société Industrielle de Mulhouse."*

This water-wheel is of the kind called plane bucket, or *breast wheel,* and is inserted in a circular sweep, or breast. The following figure shows the principal dispositions of a section across the middle of the axis, or shaft, of the wheel:



$a\,b = 2.750$ metres, or 9.02 English feet; $c\,d = 2.674$ metres, or 8.77 English feet; $e\,f = 0.160$ metres, or 0.52 English feet; $g\,h =$ 0.445 metres, or 1.46 English feet, being the clear depth of the bucket. Diameter of water-wheel about seventeen feet.

The wheel, the breast, and the gates, are of wood, which was adopted for the sake of economy, and executed with all the care and precision desirable. The planes of the buckets are in the direction of the radius.*

The counter buckets (or soleing) leave in the upper part of each bucket a longitudinal opening of .013 metres, or *half an inch,* in width. Besides the two extreme rings, or shrouding, there are two others intermediate, which divide the buckets into three equal parts. These interior partitions, which add much to the solidity of the wheel, are, moreover, destined to answer another purpose, of which we shall speak further.

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* The advantageous results developed by this wheel with radial buckets, show how unnecessary it is to construct them with elbows, or inclined to the radius; both of which methods, and especially the elbow buckets, are very much used in the breast water-wheels of this country. Com. Pub.

The circular sweep, in its upper part, is, by a parabolic curve, brought to an even surface, with the portion of a parabola, which forms the sill of the gate; at its lower part it is terminated by a tangent plane, descending about one-tenth of a foot in its length of 9.84 feet, or at the rate of one in one hundred. The outer extremity of this plane, or apron, forms a sill, or step, (.30 met.) .98 feet high above the bottom of the tail race. The gate (which is of the waste-board form, so as always to draw on the water from the surface,) has its top formed of a parabola, calculated for a depth of water over it of (.20 met.) or .65 feet. Four partitions, placed opposite to the four rings of the wheel, divide this waste-board gate into three spaces, or bays, the breadths of which are a little less than those of the corresponding portions of the buckets. Each of these bays can be closed by a thick oak plank, so managed by rods that the water may be admitted at will by one-third, two-thirds, or the whole of the gate.

The origin of the fluid vein flowing over the up stream edge of the sill of the gate, is about (.46 met.) 1.50 feet distant from the wheel, so that for a lowering of the gate of (.020 met.) .656 feet, this fluid vein strikes the buckets at a mean vertical depth of (0.40 met.) 1.312 feet, or with a velocity of about (2.80 met.) 9.18 feet per second.

The greater part of these arrangements are comformable to those of wheels before described, and admitted to act satisfactorily; but there are some which appear to me novel, and on them I wish to fix the attention of the "Société Industrielle:" I will speak, first, of the intermediate rings of the wheel, and of the corresponding partitions adapted to the gate; second, of the distance of the gate from the wheel.

We have before stated how we can at will receive the water by the third, the two-thirds, or the whole of the breadth of the gate—the two interior rings dividing the buckets, so that in these several circumstances the water exerts its force on the third, the two-thirds, or the whole of each bucket.

We have adopted this arrangement with the view of making the water act on the wheel in a manner sensibly equal, though very variable, volumes be expended. In effect it is evident that the thickness of the billow of water introduced upon the wheel, has a great influence upon the results, whether by the manner in which it arrives and strikes upon the buckets, or by its mode of action in the circular breast, and in this last respect, notwithstanding the careful construction of the wheel, it is certain, that there is always an appreciable interval between the buckets and the breast, by which a portion of the water escapes without effect on the motor.

The loss of power due to this circumstance being sensibly proportional to the breadth of the breast, we see that so long as this breadth remains the same, the loss will affect the result so much the more, as the quantity of water acting may be the less considerable. But if, at the same time that the expenditure of water diminishes, we contract the breadth of the breast, we may hope to establish a sort of compensation leading to very nearly identical results. This, in fact, *has now been confirmed by experience.*

I come now to speak of the distance of the gate from the wheel, and of the form to be given to that part which forms the waste-board, (or sill over which the water flows upon the wheel.)

M. Morin, in his Memoir on Water-Wheels, (Metz, 1836,) page 66, advises the adoption of waste-board gates *placed the nearest possible to the wheel.*

Ours is remote, since there exists a distance of (0.46 met.) 1.509 feet between the wheel and the up-stream edge of the sill of the gate.

Thus by this arrangement the fluid vein strikes the buckets nearly perpendicularly, at a point very near the breast, and with a velocity, which, at a mean, only surpasses that of the buckets by about (1 metre) 3.281 feet per second, of an opening of 0.20 metre, or .656 feet —a velocity which diminishes in proportion as this opening is itself diminished, but which, nevertheless, always exceeds that of the buckets, a condition indispensable to the proper introduction of the water.

In drawing more of the gate of the wheel, we expose it, on the one hand, to carry the fluid vein upon a part of the bucket very near the soleing, or on this soleing itself; and, on the other, to cause it to strike the buckets at a point where their velocity exceeds that of the entering fluid, which will occasion a shock in a direction contrary to the movement.

Of itself, this observation, which appears not without importance, urges us to declare, that the advice given by M. Morin, in the work before cited, has served, in the main, as the base of the other arrangements which have been adopted for the construction of the wheel; and experiment seems to prove, we have had reason to take it, for a guide.

We will now say a few words on the inclined plane which terminates the circular breast. We find it employed in very ancient water-wheels, and yet in many recent constructions it has been suppressed. This is evidently wrong, for in preserving to the water which issues from the wheel, the velocity which it has in common with the buckets, it is clear we facilitate its disengagement, and we can use this same velocity to repel the water of the tail race, which may thus, without inconvenience, elevate itself to (0.10, or 0.15, met.) .328, or .492, feet above the lowest point of the wheel.

To verify the justness of the principles of which the preceding is an exposition, experiments with the *friction brake* have been made on the wheel in action.

The brake used is that of the establishment of Bitschwiller, which M. M. Stehelin and Huber have had the kindness to loan us, and which has been applied under the direction of one of their hands accustomed to experiments of this kind. The pulley of this brake is (0.70 met.) 2 296 feet in diameter, on a breadth of (0.26 met.) .853 feet; the length of the lever is (3 metres) 9.843 feet.

It was placed on the prolongation of the shaft of the wheel, so that the resistances to be overcome were, besides those of the brake, the friction of the shaft of the wheel on its two bearings, and that of the additional shaft on its single bearing.

We see then that the power consumed by the brake may be sensibly considered as equal to the useful effect transmitted by the wheel. The precautions known to be necessary in applying the brake, were scrupulously observed. The numbers inscribed in the table relate to the periods, during which we observed a great regularity in the oscillations of the brake, and in the velocity of the wheel.

The gauging of the water we had only the power to make by a single method: we noted the depth, H, of the sheet of water on the sill of the gate, and from it deduced the volume of water issuing by the known formula,

$$Q = mHL\sqrt{2gH},$$

H = the vertical depth of the edge of the gate below the level of the head race, was taken at a point (1.50 met.) 4.92 feet above the gate. The constant m, was assumed at 0.4.

We maintained very precisely (by means of a regulating gate,) the surface of water, in the head race, at a constant height during the whole time of the experiments.

Below, when the wheel was stopped, the water backed up to the lower extremity of the inclined plane which terminates the breast. The fall was counted from the surface of the head to that of the tail water, taken at the lower extremity of the inclined plane.

Occasionally the level of the water varied somewhat below; but it is evident that we might elevate its surface sensibly without prejudicing the motion of the wheel, and, consequently, the falls adopted in the calculations are rather too great than too little.

If we cast our eyes upon the following table, we see that it is divided into *nine series*, of which—

The first *three*, A, B, C, are relative to expenditures of water, which differ little from (200 litres) 12,200 cubic inches, or 440 pounds per second.

The *fourth* and *fifth*, D and E, relate to expenditures of (300 litres) 18,300 cubic inches.

The *sixth* and *seventh*, F and G, relate to expenditures of (400 litres) 24,400 cubic inches.

Finally, the *last two*, H and I, relate to expenditures of (500 litres) 30,500 cubic inches.

The power of the brake did not permit of going beyond this.

Having compared the results recorded in this table, let us observe, that those of the *three last series* appear superior to what we should have expected, and to what are generally admitted.

As this became known to us during the course of these trials, we redoubled our attention, and verified minutely all the bases of our calculations, in order to see if we could not find errors; but not a single mistake could be discovered, and the regularity of the results of the three series, G, H, I, to which they relate, render it improbable that any of importance can exist.

The only debatable point is the application of the formula for gauging the water,

$$Q = mLH\sqrt{2gH};$$

in using which we adopted the constant coefficient of 0.4 for m, which is very nearly the average of those resulting from experiment; but of all the means usually adopted, this, which is the most simple, appeared to me also the least liable to error, when we took care (as we did) to maintain the level invariable during the whole series of experiments.

We believe ourselves safe, then, in regarding as true, or rather as approaching very near to the truth, the results of our experiments, which we may sum up as follows:

I. When the water is conducted to the wheel by the *three* bays of the gate, and when the lowering of the gate is comprised within the limits of (0.15 to 0.20 met.) .49 to 0.65 feet, which corresponds to a volume of water of (400 to 600 litres,) 24,400 to 36,600 cubic inches per second, the effective power of the wheel deviated but little from eighty per cent., (see series G, H, I.)

II. This effective power diminished for smaller volumes of water: it is only seventy-three per cent. for (300 litres) 18,300 cubic inches, and fifty-two per cent. for (200 litres) 12,200 cubic inches, (see series E, C.)

III. The effective power for (200 litres) 12,200 cubic inches, rose to sixty-six per cent., when we employed *the two side bays* of the gate, and it reached seventy-one per cent., when we used only that of the middle.* (see series A, B.)

IV. For an expense of (300 litres) 18,300 cubic inches, there is not much difference between the use of the entire gate, and that of the two side bays only.

V. The velocities of the circumference of the wheel may vary without sensibly influencing the effective power from (1.40 met.) 4.59 feet, to (2 met.) 6.56 feet per second.

At a time when the views of constructors are turned towards the means of realizing the best possible effect from water powers, and when many systems of motors are presented, it seems to me useful to call the attention of the "Société Industrielle," to the good results obtained with a wheel of a simple and economical construction, which may be employed in many circumstances.

Explanations referring to the Table.

met.—French metres, each 3.281 English feet. kil.—French kilogrammes, each 2.20485 avoirdupois pounds, or nearly two and one-fifth pounds. km.—A French dynamical unit, being kilogrammes lifted one metre high in a second.

A horse power of 33,000 pounds, lifted one foot high per minute, is nearly seventy-six and one-fourth km.; the horse power generally employed in France, as a dynamical unit, is seventy-five km. A litre is 61.02802 cubic inches, which quantity of water weighs just a kilogramme, so that in measuring this fluid, litres and kilogrammes are identical in weight.

It will be perceived that the clear length of bucket in this wheel is about 12½ feet; and that its available force with the entire gate drawn down 0.20 metres, or .656 feet, is about 18 horse power.

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* This and the preceding prove conclusively, that the same quantity of water confined, so as to form a thick sheet in flowing over the gate, is much more effective on a breast wheel, than when the same volume is used in a thin sheet, *the difference here shown being as 52 to* 71. Com. Pub.

Number of Series.	Number of Experiments.	Disposition of the Gate.	Breadth of the Orifice.	Depression of the Gate.	Weight of water expended per second.	Height of the Fall.	Theoretical Power of the Motor per second in km.
			Met.	Met.	Kil.	Met.	Km.
A	1 2 3	The middle bay.	1 247	0 202	200	2 725	545 "
B	4 5 6	The two extreme bays.	2 463	0·127	198	2 725	539 55
C	7 8 9 10	The three bays, or the entire gate.	3 710	0 095	193	2 725	525 92
D	11 12 13	The two extreme bays.	2 463	0 169	303	2 710	824 13
E	14 15 16	The entire gate.	3 710	0 129	304	2 710	823 84
F	17 18 19	The two extreme bays.	2 463	0 192	367	2 705	992 73
G	20 21 22 23	The entire gate.	3 710	0 154	398	2 700	1074 60
H	24 25 26 27	The entire gate.	3 710	0 180	502	2 685	1347 87
I	28 29 30 31	The entire gate.	3 710	0 204	605	2 685	1624 42

Number of turns of the Wheel in a minute.	Velocity of the outside circumference in a second.	Load of the Brake.			Useful Effect, or Power available, per second.	Ratio of the Useful Effect to the Power Expended.	Mean of these Ratios by Series.
		Constant.	Variable.	Total.			
	Met.	Kil.	Kil.	Kil.	Km.		
7 “	1 876	71 80	105	176 80	388 80	0 71	0 71
6 “	1 608	“	135	206 80	389 80	0 72	
5 26	1 410	“	165	236 80	391 55	0 71	
6 56	1 758	“	105	176 80	364 93	0 67	0 66
5 57	1 493	“	135	206 80	361 “	0 66	
4 80	1 286	“	165	236 80	357 “	0 67	
5 “	1 340	“	105	176 80	277 80	0 52	0 52
4 41	1 182	“	135	206 80	286 63	0 54	
5 90	1 581	“	75	146 80	272 18	0 52	
6 46	1 631	“	60	131 80	267 55	0 50	
7 “	1 876	“	195	266 80	586 74	0 71	0 72
6 “	1 608	“	245	316 80	597 17	0 73	
5 09	1 364	“	295	366 80	585 94	0 71	
7 “	1 876	“	195	266 80	586 73	0 71	0 72
6 “	1 608	“	245	316 80	597 17	0 73	
5 22	1 399	“	295	366 80	601 23	0 73	
6 31	1 691	“	295	366 80	727 82	0 73	0 73
6 88	1 844	“	265	336 80	728 53	0 73	
5 33	1 428	“	355	426 80	715 12	0 72	
7 62	2 042	“	295	356 80	878 “	0 82	0 82
6 88	1 843	“	345	416 80	901 47	0 84	
6 09	1 632	“	395	466 80	892 67	0 83	
5 22	1 399	“	440	511 80	838 91	0 79	
6 56	1 758	“	440	511 80	1055 18	0 78	0 795
6 56	1 758	“	460	531 80	1096 25	0 81	
7 12	1 908	“	410	481 .80	1077 52	0 80	
6 72	1 800	“	435	506 80	1069 95	0 79	
8 “	2.144	“	460	531 80	1336 58	0 82	0 81
7 05	2 010	“	485	556 80	1311 95	0 80	
7 25	1 943	“	510	681 80	1326 64	0 82	
6 88	1 844	“	535	606 80	1312 57	0 81	

FRANKLIN INSTITUTE.

Explosion of the Locomotive Engine "Richmond."

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom was referred the examination of the causes which led to the Explosion of the Locomotive Engine "Richmond," upon the 2d of September, 1844, respectfully REPORT:—

That they have used all the means in their power to collect information upon the subject of the explosion; they examined with great care the remains of the engine, as exhibited at the shop of the Messrs. Norris, and have obtained statements of the facts from all those who were near at the time of the explosion, and those, who, from their position, were in a situation to judge of the condition of the engine.

The following narrative contains all the material facts brought to light by their investigation, and is based entirely upon these facts:—

The locomotive engine "Richmond," weighing, when in working order, sixteen and a half tons, (33,000 lbs.) was built by the Messrs. Norris, of this city, and placed upon the Reading Railroad. The boiler was constructed upon the same general principles as those of other modern engines of the same weight. The fire-box was forty and a half inches wide at the widest part, forty and a half inches deep, and forty-two and a half inches high; the back plate, into which the flues were inserted, was thirty-six and three-fourths inches in breadth; the crown was nearly flat, and was stayed by seven cast-iron bridge-bars upon its top, which sustained the crown by means of stay-bolts passing through both crown and bar. These cast-iron bridge-bars were nearly rectangular in their cross section, which varied in dimensions averaging three and three-fourths inches in depth, and one and seven-sixteenths inch in breadth; but the cross section of the solid metal at the stay-bolts was less than this. These bridge-bars did not extend entirely across the crown of the fire-box, so as to rest upon its vertical sides, but terminated about one-fourth of an inch short of the bend by which the crown is joined to the sides. They were not in contact with the top of the fire-box, except at their ends, and at the washers of the stay-bolts, but had a space between, which, at their centres, where it was greatest, amounted to about one-fourth of an inch.

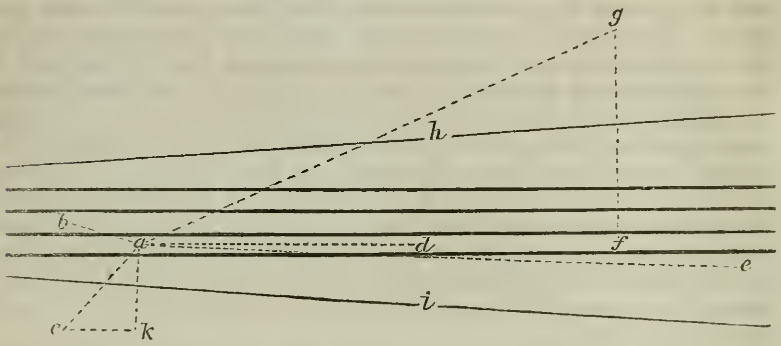
The engine was placed upon the Reading Railroad upon the 14th of August, 1844, and continued to run until the 2d of September, with but few and trifling intermissions; the only one of importance of which, was caused by a required alteration in the valve-rod of the cut-off valve gearing, which change was made at the shop of the Messrs. Norris. The greatest amount of load which the engine had, up to this time, pulled, was seven hundred and sixty tons gross, and the greatest pressure of steam to which it had been subjected, is supposed to have been about one hundred and fifty pounds per square inch. After the alteration in its valve-rod, the engine had made eight trips, four of which were down the road from Pottsville to Philadelphia, drawing an average load of six hundred and five tons, and four were up the road, drawing, on an average, two hundred and thirty-two tons gross. (It will be recollected, that the road is so constructed as to have no ascending grade in the passage from Pottsville to the Falls of Schuylkill: the loads down are generally cars laden with coal, the loads up, the empty cars.) No defect was found in the working of the engine, except that, as will be seen by the evidence, the pumps had been found to give even more trouble than is usual in new engines. The pumps in the Richmond were placed immediately under the steam cylinders, the supply valves being at the forward end of the cylinders, and the check valve at the point where the water enters the boiler, a short distance behind the cylinders. The pipe leading from the supply valves to the boiler passes between the cylinder and boiler: the try-cock is upon this pipe, and just behind the cylinder. On Saturday, August 31st, upon the down trip, it was found necessary to stop the engine near Manayunk, and take the pumps apart; and it will be found, by the testimony of Mr. Day, that upon the very day of the explosion, at Pottstown, Mr. Ward, the engineer of the Richmond, was occupied in unscrewing the caps of his pumps, in order to get them to work.

Upon the 2d of September, the Richmond reached Reading from Philadelphia, at 7h. 18m. P. M. At this time there is every reason to believe, (although there is no direct testimony to this effect,) that the water was high in the boiler:—the steam was low, and the valves were not blowing off. At the depot at Reading, the engine took in a supply of fuel, (oak wood) and filled its tank with water. No fan was used upon the engine to increase the draft.

It was detained at the depot sixty-seven minutes, during the latter fifteen of which it was shifting cars, and preparing to start; whether the fire doors were left open during this time is not recollected, but when the engine left, the steam was blowing off moderately at both valves, at a pressure of about one hundred and twenty pounds. During the period of the detention of the engine at Reading, a violent thunder storm from the north-west was raging at that place, but before the engine left it had passed off to the south-east, and the rain had so far ceased, that Mr. Ward had laid aside his water-proof overcoat: the night, however, remained exceedingly dark.

After leaving the depot, the engine hauling a load of eighty-eight empty coal cars, (weighing two hundred and eleven tons,) passed up the road, through the borough, at the rate of four, or five, miles per hour. Fifteen minutes after leaving Reading, and at a distance of 2.02 miles from the depot, the boiler exploded. The time of the explosion is indicated by the stoppage of the conductor's watch, which was crushed in his pocket, by his fall upon the sills. The road at the point at which the explosion took place, runs upon an embankment five feet high, and has an ascending grade of six feet per mile. At the exact place of explosion the road is straight, but the train behind lay in a curve of three thousand feet radius.

The condition of things, as found immediately after the explosion, was as follows:—(The accompanying diagram, kindly furnished by Mr. Nicolls, the superintendent of transportation of the Reading Railroad, will render the description more intelligible.) The road at this point runs nearly north and south; the boiler itself, with its cylinders, dome, and fire-box, was thrown to the north-west, a distance of two hundred and forty-nine feet; its distance in a perpendicular direction west of the centre of the track being seventy-eight feet.



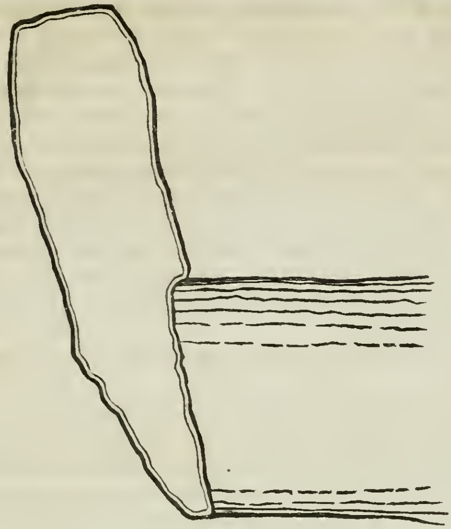
a, spot where the engine exploded; *b*, body of fireman; *c*, body of engineer; *d*, body of fireman; *e*, body of conductor; *g*, spot where the engine lodged; *h*, foot of embankment; *i*, ditto.

a b, 20 feet; *a c*, 54 feet; *a k*, 32 feet; *a d*, 155 feet; *a e*, 326 feet; *a g*, 249 feet; *k c*, 44 feet; *f g*, 78 feet; *e*, to the rail is about 4 feet.

The embankment is five feet high at *a*, and eleven feet at *f*; the line is straight, and rises from *a*, towards *f*, at the rate of six feet per mile.

This sketch is not drawn by a scale, though the measurements were taken on the ground.

The boiler was found lying with its cylinders to the north, and its fire-box towards the south, its axis nearly parallel to the track, its dome was downwards, and its safety valve seat broken at its upper edge; the blow, in lighting, had taken effect upon the hinder part of the boiler, and near its right side, and by this blow the fire-box, and the part of the boiler surrounding it, had been driven to the left and front, and very much flattened, so as to present the appearance shown in the accompanying section, made by the draughtsman of the Messrs. Norris. The body of the conductor, who, when the engine left Reading, was sitting upon the sand-box, which is on top of the boiler, and just behind the smoke-pipe, was found lying close upon the east side of the track, at a distance of three hundred and twenty-six feet forward, or northward, of the point of explosion; one of the firemen was found upon the track, at a distance of one hundred and fifty-five feet northward; the body of another fireman was found twenty feet to the south-west; and that of Mr. Ward, the engineer, at a distance of fifty-four feet to the south-east of the position of the engine.



The tender was found scarcely damaged, and *with the water turned on to both of the engine pumps.* The condition of the boiler gave signal evidence of the energy of the force which had caused the accident. The crown of the fire-box had been torn off just inside of its edges, and outside of the ends of the bridge-bars: this rupture appears to have taken place instantaneously all around, except at one point, where the iron had resisted sufficiently long to twist, or fold, the crown at right angles as it fell, so that the bridge-bars were seen, by looking in through the fire doors, in a vertical, instead of a horizontal, position. These bridge-bars, which, as before stated, were of cast-iron, and had a cross section of three and three-fourths inches, by one and seven-sixteenths inch, had broken off at the stay-bolts, and never at the bolt in the middle of the bar, but always at the first, or second, bolt from the ends.

The violence with which the crown was driven down, is indicated by the fact of a rupture of the iron of the front of the fire-box, evidently caused by a fragment of one of the bridge-bars being driven through it from within. (Below this, and to the right of it, another rupture exists in the outer shell of the boiler; the force which produced this has evidently acted from without inwards, and it doubtless was caused by the fall, as it exists in that part which first struck the ground.) The rivets by which the plates of the fire-box were connected, are cut off as smoothly as wax would be by a pen-knife, and this is the case also with some of the screw-bolts, by which the foot-board was suspended from the boiler; the copper tubes, or flues, of the boiler were good, with the exception of one, or two, which had been bent, and slightly broken at the fire-box end, and the existence of a slight incrustation upon them, showed that they had not, at least for any length of time, been heated to a temperature much above that usual in a locomotive boiler.

The cylinders and accompanying valves were still good; the framing of the engine, and the stays, or knees, by which it was supported upon the frame, were broken, and the connexions of the engine broken and twisted exceedingly. The ash-pan had been driven down upon the track with such force as to mould itself over one of the sills of the road, whilst its upper surface was marked by the indentations made by the grate-bars when driven down upon it. The foot-board was also much torn by the violence with which it had been driven downwards. The rails of the track, upon which the engine was running, were spread outward; the rails of the opposite track were broken in two places; the leading wheels of the engine are marked each by a deep cut in the flange, and one had a portion of its tyre cut out as though by a plane.

In reference to the quality of the materials of which the engine was made:—

As the outer shell of the boiler had suffered no fracture, except where it was battered and ruptured by the fall, the committee had no hesitation in assuming both its materials and its construction to be good. The iron of the fire-box was found to be very much laminated, dividing into four, or five, distinct and entirely separate layers, as the accompanying specimens will show. The fractures of the pieces broken by the committee, were not indicative of an excellent material, but as we possessed the means of ascertaining the actual tensile strength, we were, of course, not satisfied without submitting it to that test. Accordingly, four pieces were taken from the crown sheet of the fire-box immediately along side of the line of fracture, two of which were cut in the direction of the grain of the iron, and two against it. These pieces were reduced, by filing, to a proper cross section, and placed in the apparatus belonging to the Franklin Institute, when the breaking weights were found to be as follows:—

No. 1,	Across the grain,	Breaking weight	51.120	lbs. pr.	sq. in.
No. 2,		"	55.320	"	"
No. 3,	With the grain,	"	50.280	"	"
No. 4,		"	51.120	"	"
Average of No. 1, and No. 2,		"	53.220	"	"
" No. 3, and No. 4,		"	50.700	"	"
" the four pieces,		"	51.860	"	"

The fracture in each case was fibrous, (the weight having been applied very gradually,) but it was dull. It will be observed, that since the rupture took place, in the short space between the bend of the edge of the plate, and the ends of the bridge-bars, the iron was not, in fact, subjected to a force in the direction of its length, but to a twist and cross strain, which might cause it to yield to a less force than that stated above. Two other pieces of the iron, in the possession of the Messrs. Norris, have suffered themselves to be bent double, the one while hot, and the other when cold, without indicating any signs of fracture.

The bridge-bars, by which the crown of the fire-box was supported, were made of cast-iron, and had a cross section (as before stated,) of

$3\frac{3}{4}$ inches by $1\frac{7}{16} = 5.4$ square inches; but this cross section was somewhat diminished at the stay-bolts, at which they broke. They had a span of forty inches, and were slightly arched, and their operation would, in consequence, be to transfer the whole strain upon the upper surface of the fire-box, to the points at which they rested upon the crown. The iron of which they were made, was, as will be seen by the specimens, very soft, and dark gray.

The committee believe, from the fact, that not a single portion of the joints had given way, except where the rivets had been shorn off by the lateral expansion, and from the general appearance of the remains of the engine, when examined, that it will, on all hands, be admitted, that the workmanship of the boiler was such as to sustain the reputation which the Messrs. Norris have acquired in their business; and it is evident that the experiments, cited above, refute any supposition of insufficient strength in the crown plate—the laminated structure of which is one of those contingencies, against which the most careful precautions are not always sufficient to guard.

It is not then to weakness of materials, or defects in the manufacture of the boiler, that we are to look for the cause of this explosion: the committee believe that the strength of the engine would have proved adequate to any working pressure which could have been placed upon it.

On the other hand, the engineer, Mr. Joseph Ward, was reputed one of the most capable and trustworthy upon the road, and his character for carefulness and sobriety was such as to forbid the suspicion of any improper tampering with the valves: we have besides evidence that the valves were free.

The whole results of the explosion moreover seem to indicate, not the slow and gradual rise of the pressure of the steam to a force which the engine was unable to bear—a force, be it remarked, not easily obtained upon a well built engine while in motion—but rather the action of a force of great intensity, and generated with such explosive suddenness as to render the safety valves and cylinders of the engine useless as means for giving it vent.

In the first accounts of this explosion much stress was laid upon the fact of its having occurred during a thunder-storm, and the agency in the accident has been attributed to electricity; but in what manner it may be conceived to have acted; whether by heating the boiler, or the steam, within it, or in what other way it increased the tension of the steam, or diminished the strength of the material, the committee cannot conjecture. If there are any experiments, or observations, on record, tending to show the power of electricity to produce such effects in a good continuous conductor, as a locomotive engine, running too, be it observed, upon a wet rail, the committee are in ignorance of them; and, independently of this, the evidence to the contrary is as plain as could be desired.

In the testimony before the coroner, two of the brakesmen, Powell and Cowden, declare that they saw lightning previous to the explosion: Powell says,—"I saw a flash of lightning previous to the explosion, but I could very easily see between the flash and the explosion." Cowden says,—"I saw several flashes of lightning previous to the explosion." Neither say any thing of the nature, or the nearness, of the flash, nor do they seem to have attributed to it any agency in the explosion. On the other hand, two other brakesmen, McGuire and Smith, declare that they saw no lightning, and heard no thunder, which is scarcely reconcilable with the supposition of lightning striking the boiler. Messrs. Weber and Shipp, persons residing near the place of accident, both of whom saw the explosion, agree likewise in the statement that there was no lightning at the time.

In the testimony collected by the committee, it will be found that the storm, which (as is most commonly the case with our thunder storms,) had come from the north-west, had passed off to the south-east, and was almost entirely over before the Richmond had left Reading, so that Mr. Ward had laid aside his outer coat. Mr. Spayd also asserts with confidence, that for some hours previous to, and after, the explosion, there was no lightning to the north of Reading; he heard the explosion, and is sure there was no flash at the same moment. Messrs. Hiester, Herbst, Richardson, and Gruber, all testify to the same absence of lightning. The evidence, therefore, alone is perfectly conclusive, that the explosion was not due to the fact of the engine being struck with lightning.

But there is another cause, which, if we can suppose it to have been in action, is quite sufficient to account for all the effects observed. We allude to the rapid generation of steam of enormous tension, when water is suddenly brought into contact with a part of the boiler unduly heated. The agency of this cause is now so well understood, and its circumstances have already been so carefully investigated by a committee of the Franklin Institute, that we need say no more upon the subject, but proceed to inquire whether such a cause can be supposed to have acted in the present case.

It may be admitted that when the Richmond reached Reading at 7h 18m. P. M., the boiler was filled with water as far as the upper cock, which would give about thirty cubic feet of water above a plane one inch below the crown of the fire-box: (the length of the cylindrical part of the boiler is nine feet six inches, and the crown of the fire-box is eleven inches below this line.) And the evaporation of the Richmond, as calculated by the Messrs. Norris, from the dimensions of its cylinders, is 525 gallons, = 84.24 cubical feet per hour, when running ten miles per hour, with steam of one hundred pounds. To this may be added, according to the opinion of Mr. Kirk, who has great practical experience in these matters, at least fifteen per cent. additional, owing to the condition of the rails, and some additional quantity for the blowing off from the safety valves.

In fact, a carefully conducted series of experiments, upon a very similar engine, tried and recorded long before this accident happened, gave eighty-seven cubic feet as a minimum, and one hundred and thirty-three cubic feet as a maximum, evaporation per hour. While the average of a very extensive series of experiments, made by Mr. Nicolls, the superintendent of the road, with a number of different engines, while they vary very much from engine to engine, give about one hundred and fifteen cubical feet per hour for engines running at ten miles per hour.

As the Richmond seems to have been engaged in shifting cars for about fifteen minutes before its start, and as the explosion took place about fifteen minutes after it left the depot, the very lowest of these estimates show that its evaporative power was amply sufficient to have reduced the water below the crown of the fire-box, provided the pumps did not work.

What then was the condition of the pumps? It will be recollected that the pumps are beneath the cylinder, and that the pipe leading from the supply valves to the boiler passes between the cylinder and the boiler. All these arrangements are avowedly made for the purpose of keeping the pumps warm when in danger of freezing in cold weather.

That the pumps actually did not work perfectly, there is abundant proof. Thus Mr. Kirk, foreman of the Reading workshops, and Mr. Loeser, a clerk at the depot, both testify that Mr. Ward had several times told them that the pumps did not work well, and that they had given him much trouble.

Mr. Yeager, the engineer of the freight train, which was immediately behind the Richmond when she exploded, testifies to Mr. McCabe's (the conductor's) statement, as to the cause of delay on the Saturday preceding, at the Manayunk tunnel, to which Patrick Nugent, a brakesman upon the train, also testifies; this is, moreover, confirmed by the statement of Mr. Simpson, at the time foreman of the workshops at Richmond, to one of the committee, that he did not see Mr. Ward upon Saturday evening, but that upon inquiring of another engineer, whose train had been behind, as to the cause of the detention, was told that the pumps of the Richmond had given out, and that Ward had to take them to pieces.

Mr. Day, also an engineer upon the road, testifies that Mr. Ward told him, some day of the week preceding the accident, "that his pumps worked badly, and that he never could start them without first unscrewing them, and lifting the caps." He also testifies that he passed the Richmond at Pottsville, upon the day of the accident, that Ward was then just starting, and was engaged in unscrewing the cap of his pump in order to make it work.

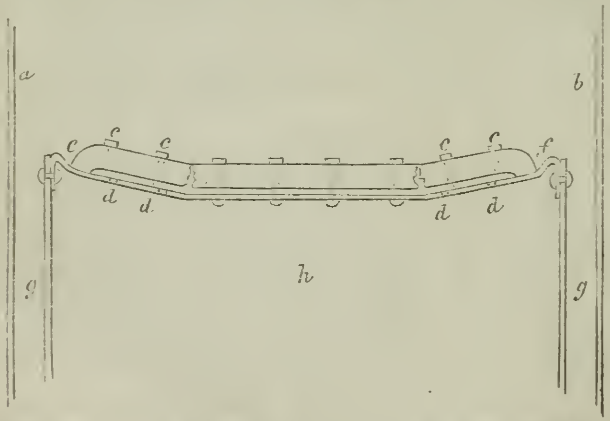
Now all those who saw the explosion testify that the engine was running under a heavy head of steam.

Cowden, a brakesman, testifies that "she had a great head of steam, and was blowing it off at the time." Weber, who was standing in his porch says, that "although not very familiar with engines, he could easily perceive that she was working differently from what engines generally work; that she had a very heavy head of steam, and was going fast, and that she appeared to him like an engine trying to go faster than she was able." Mr. Herbst declares that there was a heavy head of steam; and Mr. Gruber, who was standing with him, says that it "had high steam, was making a great noise, and was running faster than he ever saw a coal train go before." Now all this is easily accounted for, if we suppose that, the night being exceedingly dark, when starting from Reading, Mr. Ward could not tell whether, or not, his pump was in action, the try-cock being nearly the length of the engine from him, and the noise of the empty cars behind him preventing him from hearing the escape. The great increase of the head of steam would at length give him notice, although not until the water had sunk considerably in the boiler. If then he threw on the other pump, and this acted properly, he should have a sheet of water suddenly rising, upon the overheated surface of the crown-plate, and a condition of things existing exactly such as to give rise to a terrible and inevitable explosion.*

This view of the case seems, in the opinion of your committee, to be pointed out by all the circumstances, and suffices to account for all the phenomena which accompanied the explosion.†

The committee, therefore, report that, in their opinion, the explosion of the locomotive Richmond was probably caused by the sudden rise of water over the crown-plate of its fire-box, which had been laid bare by the defective action of the pumps, and had become unduly heated.

Note.—Since the above report was finished, the committee have had the opportunity, owing to the kindness of Mr. Nicolls and Mr. Baldwin, to see the result of a very similar accident, which occurred upon the Reading Railroad, in an engine built by the latter gentleman. The "Hudson" was about the same weight as the Richmond:



a b, the interior of the steam dome; *c c*, bolts of which the lower parts were sheared off; *d d*, holes left open by the shearing off referred to; *e f*, cast-iron bridge-bars as broken; *g g*, water legs, or sides, of fire-box; *h*, the fire-box.

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* The shortness of the bridge-bars would evidently transfer this strain from the surface of the crown plate to the points in which they rested upon it, and thus determine the line of the rupture.

† In this connexion it is not to be forgotten that when found, the water was turned on to both the pump pipes of the tender, whereas, it appears, from the testimony of Mr. Kirk, and is well known to all conversant with engines, that one pump, when in action, is more than sufficient to supply the water evaporated.

the bridge-bars were also of cast-iron, but were of greater cross section, and of a less span. This engine, in the absence of her own engineer, was entrusted to one who proved to be not sufficiently cautious, and was left standing upon the track with her valves screwed down "home," and the fire-doors closed, during some detention upon the road. In this case the pressure of the steam broke the cast-iron bridge-bars, and discharged itself by the openings of the stay-bolts, which were driven out, into the fire. The crown-plate of the fire-box was not broken, but was bent inwards to a depth in the centre of five inches.

In this case we see the undoubted agency of steam alone, and the insufficiency of cast-iron as a material for the bridge-bars, while the difference in the intensity of the explosions teaches us the distinction between the effect of a pressure gradually becoming too great for the resistance of the materials, and that of an almost explosive force suddenly generated by water brought in contact and under pressure with highly heated metal.*

The committee have thus ended the task which was entrusted to them, and here perhaps the report should conclude; but we cannot rest satisfied without an endeavor to call the attention of the public to a few points, which, during this investigation, have come prominently under their notice.

In the first place, permit us to draw attention to the total inefficiency of our present system of coroner's inquests. There can be no doubt that had the examination, in this case, been properly and efficiently conducted, much important information upon the subject would have been elicited. which is now forever lost, and much trouble and labor saved in the endeavor to investigate the causes of the explosion; but this subject is without the legitimate province of the Institute, and we pass it with bare notice, to refer to two other points which are entirely within the scope of our powers. In the first place, it has been brought prominently under the notice of your committee, that in consequence of the narrowness of the water-spaces between the fire-box and the outer shell of the boiler, the large engines foam so much, especially when new, that every cock in the upper part of the boiler will indicate water, while the water-spaces are filled with dry steam. In this case the gauge-cocks become worse than useless; they are actually deceptive, while the dangerous state of things around the fire-box requires no comment. Surely our ingenious mechanics will not be at a loss to contrive a remedy for this defect; and, in view of this, the committee would respectfully invite their attention to the new form of boiler devised by Mr. Johnston, and described in the "*Practical Mechanic and Engineers' Magazine,*" vol. ii, p. 407, (September 14th, 1844,) which involves a principle, as it appears to the committee, perfectly fitted to meet the case, especially if the pumps can be made to supply the cold water near the fire-box.

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* Since the occurrence of the partial explosion above referred to, we learn with pleasure, that Baldwin & Whitney have returned to their original mode of forming the bridge bars of *wrought-iron* of suitable dimensions, which, from considerations of economy, they had only abandoned in a few locomotives, after the experiments of other manufacturers with *cast iron* bridge bars had apparently shown them to be safe.

The other and last point to which your committee would desire to call attention, is the insufficiency of cast-iron as a material for the bridge-bars, by which the crown of the fire-box is sustained. We are aware that they are not peculiar to any of our manufacturers, but that they have been adopted by more than one of our very best establishments. Their economy is the only excuse alleged in their favor; but though the committee would be sorry to be the cause of increasing, in any degree, the expense of these now almost indispensable machines, they must decidedly protest against weighing a trifling reduction of price in the scale, with the vastly increased risk of life to the engineer and firemen. The committee are glad to learn indirectly, that the officers of the Reading Railroad have already ordered all the cast-iron bridge-bars, in the engines upon their road, to be replaced by others of wrought-iron; and they confidently hope that their example will be followed by other roads, and by all manufacturers, until the very memory of the error shall be obliterated.

By order of the Committee,
William Hamilton, Actuary.

Read October 10; *Adopted November* 14, 1844.

Questions upon the Explosion of the "Richmond."

1. How long had the Richmond been on the road before it was removed? what maximum load had it carried, and what pressure of steam had it borne?

2. What was the exact objection to the engine, for which it was withdrawn? where was it altered, and how long was it before it again came upon the road?

3. How many trips had the engine made after it was replaced upon the road, before the one during which the explosion occurred? what were its loads, and what pressure of steam had it borne?

4. Had any thing peculiar been remarked in the working of the engine, and if so what?

5. Was there any limit to the pressure to which the safety-valves could be screwed down?

6. At what hour did the engine reach Reading on the evening of the explosion? and what was the state of its steam, and the height of the water in the boiler when it arrived?

7. Did the engine take in fuel and water (or either,) at Reading? and what kind of fuel did the engine use? was a fan of any kind used to increase the draft?

8. How long was the engine detained at the depot? were the fire-doors open during this time, and was the steam blowing off?

9. Was the engine detained after leaving the depot, and if so, how long? what was the state of its fires and its steam during this time? what was the pressure of steam?

10. How long, after finally leaving Reading, was it before the explosion took place? and how far was the engine then from Reading?

How was the moment of the explosion determined? was it heard at Reading, or elsewhere?

11. What was the distance, and what the direction in which the boiler was thrown? and the distances and directions in which the bodies of the men killed, and the fragments of the engine were found? what was the position of the boiler when found?

12. Was any injury done to the track by which any idea of the force of the explosion can be formed?

13. What is the grade at the point where the explosion occurred? Is the road there curved, or straight? and, if curved, to what radius?

14. What load was the engine drawing when it finally left Reading? and how was it placed in the train?

15. To what pressure was the forward safety-valve adjusted? Is it known whether it worked freely in its seat?

16. What testimony can be procured from the brakesmen, or from the engineers of trains near, or from other persons, in reference to the circumstances accompanying the explosion?

17. Was there another train ahead of the Richmond? if so, with what speed was it running?

18. What were the facts in reference to the thunder-storm? did the explosion coincide in time with a flash of lightning, or had not the thunder commenced, or had it ceased, at the time of the explosion?

19. Please to procure a copy of all the evidence before the coroner's jury.

And, in fine, the committee will feel themselves under obligation to any person for any information which may tend to throw light upon the cause of this disastrous accident.

Answers to Questions on the Explosion of the "Richmond."

1. Made first trip August 14; exploded September 2; 765 tons on a level; *supposed* 150 pounds.

2. Valve rod of new "cut-off gearing" too light; rod reaching from rock shaft to steam chest; altered at Messrs. Norris' works, Philadelphia, in four days.

3. Eight, four of 605 tons *down*, and four of 232 tons *up* the road, including coal and cars; *supposed* 120 pounds.

4. Yes: the pumps gave even more trouble than usual with a new engine; the tender pulling-bar broke, and the boiler blow-off-cock, when opened, could not be shut.

5. No: all of "Salter's" safety valves may be screwed down perfectly tight.

6. 7h. 18m. P. M.; steam low, valves not blowing off, and water high in the boiler; the evidence on this point is strongly circumstantial, not *positive*.

7. Both; white oak; no, the exhaust only.

8. Sixty-seven minutes; the fire-doors were not *observed* to be open; both valves were blowing off gently when the engine left.

9. No: except by passing slowly up the Main street of Reading; say four, or five, miles per hour for one-fourth mile; answered by No. 8.

10. Fifteen minutes; 2.02 miles; by the fixed hands of a watch in the conductor's pocket, which stopped at 8h. 40m. P. M.; not heard at Reading.

11. Suppose engine going due north; boiler thrown north-west 249 feet, conductor due north 326 feet, engineer south-east 54 feet, one fireman due north 155 feet, and the other fireman south-west 20 feet; fragments of engine scattered all around the spot of explosion; boiler lay 78 feet due west of track, and its axis about parallel with the rails.

12. The rails of the track on which the engine ran were much spread and deranged; the rails of the opposite track (double track) were broken in two places.

13. Six feet per mile, ascending; straight where engine exploded; her train lay in a curve of 3000 feet radius.

14. The engine was hauling a train of eighty-eight empty coal cars, weighing 211 tons.

15. About 120 pounds per square inch; it did.

16. The brakeman next the engine, 150 feet from her, states that he heard a sudden explosion "like a quarry blast," and that immediately the train stopped, and the cars began to pile, or rise, one over another; he is sure he saw no lightning, or heard no thunder.

17. A train left Reading one hour before the Richmond, and ran from ten to fourteen miles per hour up the road.

18. Answered in No. 16; some farmers in the neighborhood saw the explosion, but saw no lightning, nor heard any thunder; it thundered and lightened considerably before the accident, and but little after it.

Depositions of Witnesses taken before the Coroner.

Patrick McGuire, sworn.—I have been on train; saw no lightning, or thunder, at the time of the explosion; felt no shock before the report; Joseph Ward, engineer.

Matthew Smith, sworn.—I saw no lightning, or thunder, at the time of explosion; it reported as loud as a cannon.

J. S. Weber, sworn.—I live about three-fourths of a mile off from the place; I remarked to my wife they are coming with too much steam; and when the explosion took place it caused darkness; but before it was light by the sparks.

Daniel Shipp, sworn.—I was on my porch; I then remarked to my wife the cars are coming; saw no lightning at the time, or thunder, in Alsace township, county of Berks, and am satisfied that it was an explosion of the boiler.

John W. Powell sworn, brakesman.—Left Reading at about eight o'clock; when standing on my post, I saw a flash of lightning and thunder previous to the explosion, but I could very easily distinguish them, or see between the flash and the explosion of the boiler.

Thomas Cowders, sworn.—Last evening McCabe requested me to come on as brakesman on the train at about eight o'clock, or quarter after eight o'clock; I was sitting on the car next to the engine; I saw several flashes of lightning and thunder previous to the explosion; she had a great head of steam at the time, and blowing it off; I saw them lying there dead, and often saw Joseph Ward, and that they came to their deaths by the explosion of the boiler of the engine named Richmond.

Testimony before the Committee.

On examination by me of witnesses conversant with the circumstances attending the explosion of the Richmond engine, the following statements were given by—

Mr. Kirk, foreman of the Reading workshops.—Mr. Ward had complained to him several times, that his pumps worked badly, and had given him much trouble; one pump, if it works well, is, under ordinary circumstances, more than sufficient to supply an engine with water. The storm of the 2d of September, the day on which the Richmond exploded, came from the north-west, and had passed off to the south-east, and almost entirely ceased at Reading when the Richmond left, so much so, that he had laid aside his umbrella, although it still rained slightly. The engine was not blowing off when she arrived, but did not notice if she was, or was not, when she left; was at the depot some time after; heard but little thunder, and but few and indistinct flashes of lightning to the south south-east. From the rails being wet, thinks engine would use about fifteen, or twenty, per cent. more steam than with a dry rail; lower cock about five inches above top of the fire-box; upper tube two inches below.

T. Loeser, clerk at depot.—Mr. Ward complained to him on several trips, that his pumps worked badly, and gave him much trouble.

—— *Rigg*, assistant clerk.—Was at depot taking account of cars; the rain had almost ceased when Richmond left; Ward had taken off his oil cloth overcoat; heard but very little thunder; took no notice of the state of the steam.

Philip Albright, depot hand.—Left the depot soon after the Richmond; as he was going to bed, about twenty minutes after nine, his wife, who was looking out of the window in the direction in which the engine was going, called him to look at a strange light, saying that it did not look like lightning, as it was all in one spot; she heard an explosion before he got to the window; he did not, nor did he see any light.

Joseph Spayd, of Reading—Says he is pretty sure that during the whole storm there was no lightning to the north of Reading, and is certain there was none in that direction for some hours previous to and after the explosion; he is sure of it, as he watched it, and took particular notice of it at the time; a few minutes after nine he was standing, together with several other gentlemen, on the steps of Mr. Kendal's hotel, in Reading; he saw a flash of lightning, and heard the thunder; it was far to the south-east; some ten, or twelve, minutes after, heard a report to the north; he, and those standing round, remarked that it was strange, and wondered what it could be, as it did not sound at all like thunder, but the report of a cannon; and that there was no lightning, he is himself certain there was none.

John Day, engineer.—Was at Richmond on the Sunday of the week previous to the explosion; the Richmond engine was then standing, with her boiler full of water, and no fire in her; he looked into the fire-box, and saw water running through the crown; called Mr. Ward, and both supposing it to come through a bolt hole, neither examined it particularly. Some day during the same week, Ward told him his pumps worked badly, and that he never could start them without first unscrewing and lifting the caps; he passed the Richmond on the trip up, on the 2d of September, at Pottstown; Ward was then just starting, and was engaged unscrewing the cap of his pump, in order to make it work; the Richmond worked harder, that is, made a louder exhaust, than any engine on the line, or any he ever saw; thinks it was owing to her exhaust pipes being too small.

T. Yeager, engineer of freight train behind Richmond—When she left she was blowing off at both valves, but not very hard; did not see Ward try either his gauge-cock, or his try-cock; was a short distance behind the Richmond when she exploded; heard the report, but it did not sound very loud; cannot say that he saw any light of any kind; it had lightened before, and did soon after; Mr. McCabe, the conductor of the Richmond, told him at Reading, a few minutes before starting, that on his trip down, the Saturday previous, he had been delayed about a half an hour at Manayunk tunnel, while Ward took his pumps apart, as they had given out, and refused to act.

Patrick Nugent, brakeman on the Richmond—Was sitting in about the twelfth car from the engine, with his head down; the explosion sounded like a cannon, or a quarry blast; no light was produced by it, nor was there any lightning at the time; there had been some a short time before, and was some after; did not see if steam was blowing off, or not; did not notice it at Reading; the train was delayed near Manayunk, on its trip down on Saturday, about half an hour; he did not know the cause of it at the time, but was told next morning by one of the firemen, that the pumps had given out, and that they had been obliged to stop and fix them.

T. J. Weber, schoolmaster.—Lives from one-eighth to one-fourth of a mile to the right of the road, at the point where the engine exploded; he and his wife came out in front of his house a little while after nine, to see if they would be likely to have more rain, as it had almost ceased at that time; he says he saw the engine come out of the cut; that, although he is not very familiar with engines, he could easily perceive she was working very differently from the manner in which engines usually work; that she had a very heavy head of steam on, and was going fast; that she appeared to him like an engine trying to go faster than she was able; and that she was throwing out more sparks than he had ever seen before; it was so dark he could not see the men upon the engine, nor the escape of the steam from her valves, the only thing he could see was the sparks; he remarked to his wife that the engineer was in great danger of bursting his boiler; a moment after she exploded; he was looking at her at the time; the report was like that of a heavy piece of ordnance; there was no thunder, or lightning, nor light of any kind produced; the report did not sound like thunder; the explosion produced no luminous appearance; the light of the sparks was instantly extinguished, and immediately after he heard the report; the thunder and lightning before and after the explosion, was to the south, and distant; there was but little after, and one clap some five or ten minutes before.

Mr. A. Hiester.—Lives about one-eighth of a mile to the right of the road at the point, when the engine exploded; was sitting in his room at the time; heard the noise of the cars approaching, and then the report of the explosion; sprang up thinking for the instant, from its sharpness and nearness, that his barn was struck with lightning; said so to Mrs. Hiester, but she replied no, that it did not sound like thunder, and that there was no lightning; but that she thought it must be an accident upon the road; Mr. H. is himself certain that there was no lightning, or light of any kind, at the time; saw some lightning to the north sometime after the explosion, not in flashes, but very faint summer sheet lightning.

William Herbst, farmer.—Was standing on Mr. Hiester's porch, together with Moses Gruber, and Reuben Richardson; saw the engine approaching with heavy head of steam; could not see if she was blowing off; was looking at her when she exploded; heard the report which sounded like a big cannon; there was no lightning, and no light produced by the explosion, but the light of the sparks was instantly extinguished; the report did not sound like thunder; there was no lightning for some time before the explosion, and that was distant, and to the south, or south-east, and but little after, and that also to the south and south-east.

—— *Richardson.*—Had just gone up stairs to go to bed; heard the report; it sounded like a cannon; is positive there was no lightning.

Moses Gruber.—Was standing on the porch with Reuben Richardson, and William Herbst; saw the engine coming; had high steam; was making a great noise; and was running faster than he ever saw a coal train go before; could see nothing but the sparks; does not know if she was blowing off, or not; could not see; was looking at the engine at the time she exploded; there was no lightning, or any thing like it; the light from the sparks, which was all he could see, was, at the moment of the explosion, instantly extinguished; he could see nothing further; the report was like that of a cannon.

Reuben Richardson—Testifies the same as the above.

The above is a correct statement of the testimony taken by me from the persons whose names are prefixed to their declarations.

ROBERT FRAZER.

Explosion of the Boiler and Steam Chimney of the Portsmouth.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, to whom was referred for examination the cause of the Explosion of the Boiler and Steam Chimney of the Steamboat Portsmouth, on the river Delaware, REPORT :—

That they have carefully examined the boiler and steam chimney of the Portsmouth, and obtained all the information necessary to a correct determination of the causes of the explosion. This event occurred on the —— August, 1844, on the Delaware, opposite to High street, within two or three minutes after the engine had commenced working, and about one minute after the blowers (which were driven by a separate engine,) were in motion. The interior cylinder of the steam chimney was rent at the part where it united with the boiler, and, in fact, formed a portion of *its* interior shell: as the exterior cylinder of the steam chimney was discontinued at this point, (as is usual, for the purpose of forming a passage for the steam,) *a large surface existed wholly unsupported by stays*, which elsewhere strengthened the chimney. If stays had been provided at this point it would have been necessary to attach them from the remote end of the boiler. The rent sheet, which, at this exposed position, should have been made of *very thick* plate,* was originally too thin, and had become still further reduced by exfoliation, caused by the fire acting on it on one side, whilst the steam—a bad conductor, corroded the other. The sheet was in some places reduced to a thickness of only one-tenth of an inch. The corrosion and exfoliation at this exposed point, were increased by the relative position of the draft doors, one of which, owing to a defect in the latch, could not be kept perfectly closed. The air rushing through the crevice deflected the flame, (which was still further heightened by this additional supply of fresh air,) against the sheet which was rent. *According to the testimony of Captain Devoe*, who voluntarily appeared before the committee, and answered their inquiries with great ingenuousness: "the boiler had borne a pressure of twenty-seven inches of steam in his presence on the Hudson river, in New York, before he purchased the boat, about the 24th of July, 1844. The hull of the vessel was two or three years old; the boiler more than six." As the rent did not occur in the boiler, however, but in the steam chimney, the age of the boiler proper is immaterial in this investigation. "The water was found to be ample by the captain seven or eight minutes before the accident, coming from the third cock. The pressure of the steam was seventeen inches only, according to the declarations of the engineer, on his death bed, made to Captain Devoe."

From this statement of facts the causes of the explosion are manifestly the following:—

1st. The original deficiency in thickness of the rent sheet, which was yet further reduced by the chemical action of the steam, and by exfoliation caused by the fire.

2d. The absence of stays at this part.

The construction and management of steam engines are now so well understood, that the term accidents, as explosions are usually called, should no longer have a place in our vocabulary: when they occur they are always the result of carelessness, and may always be prevented by reasonable precautions.

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* The inside diameter of the steam chimney was four feet four inches; as the pressure of the steam was against the *external* surface of a cylinder, the usual strength of the cylindrical form, so well adapted to resist internal pressure, was, of course, absent.

As no evidence has been submitted to the committee, that any undue pressure had been employed on board the Portsmouth, it is manifest that the steam chimney was defective long prior to the time of the explosion; it appears to the committee that the certificate of the inspector at the port of New York, (a copy of which is herewith submitted,) was not founded on a careful and accurate examination. Captain Devoe, relying on such certificate as corroborating his inquiries made previously, purchased the steamboat as safe and trustworthy. The lamentable loss of life, which has created such consternation in this city, where such events are nearly unprecedented, *cannot be attributed to his negligence.*

The use of steam chimneys being very common in this country, and numerous explosions and collapses having occurred from their use, the committee would again earnestly solicit the attention of the public to them. Were they made of suitable materials and dimensions, and carefully stayed, as they are manifestly useful in surcharging and drying the steam, they may be safely and advantageously employed; but they require *frequent and very careful* examination, and should always be made of very thick plates. These precautions are absolutely indispensable, when blowers are used for increasing the intensity of the heat; and particularly so when the latter are resorted to, to ensure a sufficient supply of steam from a boiler otherwise too limited in its dimensions to produce it. The temptation to make light and small boilers for steamboats, and to remedy the deficiency of boiler surface by blowers, is lamentably frequent on our waters, and unless a system of more frequent and careful examination could be instituted and enforced by penalties rigorously exacted, than the present law of inspection relating to steam vessels exhibits, in practice, it would be advisable to forego the use of this very common apparatus in steamboats, the steam chimney, rather than to be constantly exposed to risk from this, the weakest, the most dangerous, part of the boiler; a part moreover where danger may *sometimes* exist wholly unsuspected even by a careful observer.

The committee, in concluding this report, avail themselves of the occasion to request the attention of the constituted authorities to the manner in which coroner's inquests are usually conducted in this country, when an investigation of the causes of death should be conducted with all the intelligence which is applicable to the case. In England, from which we have derived this institution, whenever an explosion occurs attended with loss of life, every available source of information is resorted to; days and weeks, and even months, in extreme cases, are devoted to the examination of witnesses, to obtaining the opinions of scientific men of acknowledged eminence which may shed light on any department of the subject of inquiry. The evidence, at length, is published in the daily journals, and frequently commented on, from time to time, during the investigation. The public is thus aware of what occurs, and new witnesses and more opinions of scientific men are obtained. If no negligence is imputed in the verdict of the jury, the public can place a reasonable reliance on the conclusion; if otherwise, a deodand, or fine, stamps, in characters as legible as durable, the condemnation of the cause of injury. It is needless to remark how different the system is in this country; how deplorable the remissness of juries, and the apathy of an injured, a defenceless, but too patient, and long suffering public, whom the newspapers almost invariably endeavor to assure that no blame can possibly be attributed to any of the parties concerned.

By order of the Committee,

William Hamilton, Actuary.

Philadelphia, November 14th, 1844.

Address delivered by Frederick Fraley, Esq., *at the close of the Fourteenth Exhibition of American Manufactures, held by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, October,* 1844.

We are about to close this display of the products of the skill and industry of our fellow citizens, and the occasion may appropriately be improved by some considerations which naturally force themselves on the mind on such an event. The history of the useful arts is the history of man in his civilized state. In whatever direction we turn our eyes, this truth is most emphatically exhibited, and all the discoveries of modern times bear their testimony to its correctness. If we search the ruins of Egypt, or the more imperfect memorials of western Asia; if we explore the hitherto almost untrodden wilds of America; or if we study the history of man as recorded in sacred and profane history, we find that just in proportion as he has put on the habits of civilized life, the comforts bestowed by the useful arts attend his path, and fit him to tread it under those feelings which connects him most closely with the great Author of his being. Man may be appropriately described as the creature of wants; his mind even in its most uncultivated state, cannot remain in a state of inactivity; it must either be at work for the elevation of the individual, or for the benefit of the race.

The pursuits of the wandering savage are too closely connected with the selfish feeling of the individual, to enable him to carry himself beyond the dominion of such an influence; but when even the savage, from the pressure of external and accidental circumstances, is compelled to remain stationary for a very limited period, he becomes a creature of wants; and the natural tendencies of his mind labors to supply them. Alone, or merely attended by his faithful helpmate, the shades of the forest protect their heads from the beating of the storm, or the scorching heat of mid-day. The spoils of the chase yield them food and clothing; the clear stream from the mountain spring slakes their thirst, and the pure breezes from the hill stimulate their appetites, and invigorate their bodies. But once check this wild and roving spirit by the most trivial event; let it be wounds, or sickness, or even the presence of an enemy, that compels man to fix his habitation, and at once the ennobling ends, for which he has been fitted, bud forth and blossom, and he becomes a new creature. The trees of the forest must be knitted together, and cemented by the soil, to form a permanent dwelling; the skins of the animals slain in the chase must be softened and cured by heat and smoke, so that they will not need perpetual renewal; the fruits of the soil must be collected and garnered up for a constant supply, and the operations of nature must be watched in the recuperation of the animal and vegetable kingdoms; so that the creature hitherto so dependent upon accident and chance may render himself, in a great degree, independent of both. The comforts which centre in a settled home, having been once enjoyed, the influence of example begins to operate, and the hitherto solitary hut becomes the centre of a village; men become individualized in a new aspect; and the division of labor is the necessary fruit of this new change. The isolated man finds that now it is only needful for him to direct his energies to a single pursuit, and as each feels and acts upon this truth, excellence gradually shines forth, at first by an uncertain and often obscured light, but finally in a steady and regular ray. Improvement stretches forward with rapid strides, and at last a degree of perfection is attained which leads man to remodel his first creations; and the monuments which after times display, record but imperfectly the steps by which he has reached the goal.

Such is a brief sketch of the history of man: nation after nation, of whom the record only remains in the majestic pyramid, or the chaste but decayed temple, have run such a course; and as successive generations have appeared upon the great theatre of the world, they have trodden the same path, and each in turn found, when they had almost neared the zenith, that the wise man of inspiration gave utterance to a truth fitted to all times, and all conditions of men, when he proclaimed that there was "nothing new under the sun." But although such is the inevitable law under which man fulfils his destiny here, ought it to induce him to strive against the progress of improvement? Who will not answer most sincerely and decidedly in the negative?

Who would be willing to exchange the comforts, nay luxuries which surround us, attended as they necessarily are by some restraints of personal independence, for the uncontrolled freedom enjoyed by man in his normal condition?

Who would be willing to exchange those intellectual gratifications which are yielded by the poetry, history, statuary, painting, and music, of the refined and cultivated Greeks and Romans, for the strictly sensual gratifications that characterize the wandering and savage nations by whom they were surrounded? Compare the condition of France, Britain, or America, at this day, with that of the nations now covering the soil of Egypt, and western Asia, or even with that of China, whose boastful people connect themselves with the time immediately succeeding the deluge; and how greatly does the former preponderate.

Although their path is not attested by the magnificent piles which, whatever may have been their object, show that millions must have groaned under the toil necessary to erect them; a more benevolent and catholic spirit has been watching by the way side, and at every step they have made in real civilization, the pulses which have recorded the advance, have successfully thrilled in the veins of class after class, until the humblest individual has known and felt that he had a destiny far above that of the beasts that perish. While in the earlier ages, the possession of knowledge, and power, and wealth, was confined to the kings, and priests, and nobles, the present state of the world exhibits a more general diffusion of those gifts, and the classes of society that were formerly chained to the soil, or still more effectually chained to the will of a despot, now control the destinies of the world, and governments are raised up, or cast down, at their bidding. How important, therefore, it becomes that such a power should be wisely and well directed. Left to the naturally selfish impulses of his nature, man is always striving to elevate himself—educated to the great truth, that he must, in civilized society at least, be, in a great degree, a dependent creature, his selfishness is changed to a new principle, and that principle is to make the country, or the city, in which he lives, greater and more prosperous than those in her neighborhood, or those of foreign and distant parts. As the new principle enlarges, he is willing to extend the circle of his affections and efforts; and finally, in some few things, civilized men of all nations agree to stand on a common ground, and to recognize these common principles as the rules for their international intercourse. The aggregation of the small communities of a country into states and kingdoms, is another consequence of the existence of the principle just referred to; and when society reaches this point, a new development of the principle of the individualization makes its appearance. This is the distinction of intellectual efforts, and it shows itself in a great variety of forms. With some, the examination of the material substance by which they are surrounded, is the ruling spirit—the laws that govern the motions of the sun and planets—the changes produced by the action of air, moisture, and heat—the new and useful products yielded by the combination of one, or more, substances together, occupy the attention of others, and make in the hands of such inquirers the arts and sciences. As the great truths of nature are thus won from her infinite laboratory, the simple generalizations from first experiments yield to the more subtle inquiries of the philosopher; and at every step almost he finds some new lights shed upon his path, so that in the experimental part of physical science, at least, he learns that there is always something beyond his present attainments; and, when that is reached, a still wider and diversified field invites his continued scrutiny. I have indulged in these views of the case from a conviction that there are by far too many who undervalue the inquiries, which, at the present time, occupy so large a share of the attention of men of science. They compare the present with what existed half a century ago; and while they exclaim with delight and wonder at the progress they have witnessed, they forget that even while the burst of gratification is swelling their hearts, some one but a little removed from their stand is already in advance. We find sufficient illustrations of the correctness of the position, in the rapid communications that now exist between Europe and our country. Although American genius has doubtless contributed her full share to the common stock, how often do we find ourselves outstripped by the use in foreign countries of our own inventions. Sometimes they scarcely allow us to whisper them, before we find them spread upon our tables in the pages of an European periodical, and claimed as of foreign origin; and there is scarcely an American mechanic, or philosopher, who has not experienced this mortifying occurrence. The correction of the evil may be difficult, but it ought to be undertaken; the method of accomplishing it is undoubtedly that which, to some extent, prevails abroad, in the intimate union of the philosopher with the artizan; not so much the existence of the two in the same individual, as that spirit of confidential intercourse between the man of science, and the man of art, as will lead the former to communicate freely what he himself discovers, or what has been discovered by others, and the latter willingly to test the application of these discoveries in the workshop; frankly to acknowledge their advantages, if such be realized, or with equal frankness to state when and how they fail. That such an unison of effort is practicable, we have proof already in numerous instances in our own country, and if we look abroad we find them existing in great numbers in those countries from which we have sprung. Our illustrious countryman, Franklin, whose philosophic mind seems to have had a special mission for the improvement of his race, in his early efforts wrought upon this principle. The foundation of the Junto, the establishment of the American Philosophical Society, and the Philadelphia Library, were the instruments by which he formed the union of science and art in our city, and the honored survivors of these associations still flourish, and attest the wonderful workings of that mind, which, ennobled by the acquisition of knowledge, rose step by step from the shop of the soap boiler to the level of statesmen, and nobles, and kings. The influence exerted upon the society of our metropolis by these institutions, and the general character of Benjamin Franklin, has never passed away; its spirit has caused the city to be renowned for her establishments for education and charity, and here the great work of knitting the boundaries of the nation together by turnpike roads, canals, and railroads, has been early and steadily prosecuted. We may have gone on too rapidly for those who desire to see the usury of their monies annually poured into their coffers, but to those who take in the untold millions of posterity with a present glance, we seem hardly to have done enough. What constitutes now the boast of civilized Europe, —the bloody trophies of unblessed wars, or the soul-satisfying fruits of honorable peace?

Behold the mighty changes that have come over that land since the final overthrow of Napoleon. It may well be doubted whether if the productive industry of those nations had not been doubled and quadrupled within the last thirty years, they would not have fallen into anarchy and ruin by the weight of their war debts. But as the products of the industry of each member of society is increased, the ability of a nation to sustain the pressure of taxation is wonderfully enlarged, and a national expenditure, which in times of unsettlement and confusion, is almost intolerable, weighs but as a feather in the balance, when the hand of industry is full of work. This consideration naturally leads us to a contemplation of the condition of our own state, and of the institutions that have been established among us for advancing the common welfare. If we survey Pennsylvania according to the physical aspect presented on the map, we are struck with peculiarities not to be found so broadly exhibited in any other state of the Union. This configuration gives to her citizens the choice of a very wide range of pursuits; even should they be confined to the more elementary and pastoral occupations of man. The noble forest inviting the visit of the hunter, or the woodman; the beautiful valley watered by most noble rivers, calling the agriculturist and the shepherd to make it his dwelling place; the broad and even plain looking towards the sea, where a city would rise almost at the first footfall of the white man. But when we add to these the rich treasures that lie beneath the surface, who shall say that our lines have not been cast in pleasant places, and that we have not a fruitful land to dwell in? Our fathers have not left themselves without witnesses, that they understood and valued all these good gifts. Separating themselves from the narrow and sectarian views which at that time, in Europe, were chaining the intellectual and physical energies of man, they gave the widest range for improvement, and it is only necessary to refer you to our colonial history, to prove that here the superstructure was, with few exceptions, in perfect harmony with the foundations, laid with so much wisdom by the mind of William Penn. While a truly watchful and paternal spirit overlooked the people, the interference of government with these pursuits was of rare occurrence; and so watchful have the colonial and state authorities been on the subject of corporations, that until within a few years the creation of any, having for their object the prosecution of branches of manufacturing and mechanical pursuits, have been steadily refused, while those for charitable, literary, or scientific, purposes have been freely established, and liberally endowed out of the common stock. This policy has given us a peculiar character. Our citizens have become successful agriculturists, miners, builders, and mechanics, but they have not been manufacturers in the modern acceptation of that term.

The coal, and iron, and wool, of Pennsylvania have been largely exported to other states, and have been returned here in various manufactured forms, to be sold and distributed by our citizens to our own, and to the people of the neighboring, or distant, states. Far be it from me to desire the existence of a sectional feeling that should prevent our raw materials from filling the workshops and factories of other states; but what I desire is, that our own people should not shut their eyes to the advantages they enjoy, and be willing to profit by them. This profit can only be obtained *by confidence:* the capitalist who allows his money to lie idle, either in his own chest, or places it upon the uncertain tenure of his fears in the vaults of a bank, can scarcely realize the public injury he is thus inflicting. His wealth has been given him for no such purpose; and the retribution will come, even at the third, or fourth, generation, for his non-application of the means of doing good.

Wealth thus withheld from the uses of society will assuredly perish in the hands that hold it with so close a grasp; but if it be liberally and well directed to the hands that labor, and the heads that teach, it will flow back to the giver abundantly increased, and bring with it the blessings of those whose homes and families it has built up and sustained. Referring here again to the illustrious Franklin, and the broad and liberal forecast of his mind, we are struck with the truth of the maxim of inspiration, "that the liberal man deviseth liberal things." Although he was far from possessing millions, his *will* bears a noble testimony to his ever active and useful mind. In the legacies he bequeathed to the cities of Philadelphia and Boston respectively, he proposed a scheme for the advancement of young mechanics that is not paralleled in our own times. That it has not succeeded according to his calculations, and his hopes, is rather to be attributed to the channels through which the bounty was to pass, than to any error in his theory. There are too many duties pressing upon the time of a public functionary to permit him to attend to a matter of so much detail as the Franklin legacy, and we are to look rather to this cause than to any other, that both in Boston and this city, his objects have not yet been attained. But such failures ought not to deter the hand of liberality from contributions to those institutions, whose organization peculiarly fits them for the advancement of knowledge and industry. And of this class, mechanics' institutions, and apprentices' libraries occupy a prominent place. They take the various industrial arts out of the routine of the mere workshop, and give the artizan the possession of a new and almost infinite power; the power of useful knowledge. The traditions of the shop may, up to a certain point, make a good workman, but how vastly superior is the mechanician whose art is the combined production of well trained practice, and well directed knowledge of the properties and affinities of the substances on which he manipulates. Take, for example, one of the chaste and rich lamps, or candelabra, of our skilful townsman, Cornelius, silvered by the economic application of the new galvanic process, and compare it with the wasteful processes, and clumsy joints made in the best fabrics from European shops less than ten years ago, and our auditors will form some faint notion of what modern science has done for one of the elegant arts.

Or compare the beautiful designs and perfection of colors with which our fine woolen and cotton fabrics are covered by the use of the modern printing machine, with those elaborate but grotesque and heavy productions of the old methods of block printing, and you will acknowledge another important benefit conferred by the scientific skill that has the faculty of readily and simply impressing by unerring machinery the types of so much beauty on the copper roller. Or if we turn our attention to those arts in which heat is the great acting agent, how completely has even that subtle fluid been chained by the hand of science to the economical production of many of the necessaries and luxuries of civilized life.

Let me refer to a single instance of this, in the refining of sugar; fifteen, or twenty, years ago, it was a tedious and uncertain process, only regulated by the supposed skill of the master boiler, and if he were so unfortunate as to fail in bringing out a good article, every other cause than the right one was his apology. Now the application of steam of known tension under the evaporating vessels—the use of a partial vacuum for facilitating the evaporative process, and the conduct of the whole business under the recording of permanent instruments for measuring heat and pressure, in lieu of the eye and hand of the workmen—give a certainty and regularity to the business that enable the manufacturer to sell a better article at a greatly reduced price. I recollect, distinctly, an aged friend of mine telling an anecdote of a celebrated brewer in this city, who believed that his beer would not be good unless it had been stirred with a sassafras stick; and another of a cutler, who supposed he could not produce a good cutting instrument unless his fire had been kindled with the parings of leather from the currier's shop. These, it is true, are extreme cases; but in tracing the history of the arts, we find the sassafras stick, or the leather parings, showing their heads in some form or other, in all of them. Our purpose in these illustrations is to prove not only the advantages conferred by science on the arts, but also the necessity of men of various pursuits combining to establish institutions, in which the sciences, connected with the useful arts, may be taught, and the recorded discoveries made abroad be constantly accessible. Such an institution we have in the Franklin Institute, and such, by the influence of its example, have been rapidly multiplying in the various sections of our country. Its great object is instruction; and for the accomplishment of this, it has established schools, lectures, cabinets of minerals, models, and productions of the arts, a library, a journal, a reading room; and, finally, exhibitions, and committees of science.

To those who are not familiar with its history, the enumeration of these objects may seem rather to savor of vain boasting than of sober and unadorned truth; but to many of my hearers this enumeration conveys but an imperfect outline of the workings of our society.

The establishment of our system of public instruction in the more elementary branches of knowledge, has relieved the Institute from any care on those subjects, and the High School, founded by it, has been discontinued for some years.

The Drawing School, is, however, regularly opened every autumn, and its pupils, in addition to the instruction given therein, are allowed without additional expense, to attend the regular courses of general chemistry, natural philosophy and mechanics, and technology; and when occasional courses are delivered on other subjects, these too are open to them free of charge. The competency of the several gentlemen who fill the professorships is so well attested by the social position they hold among us, that eulogy from me would be entirely superfluous. It is due to them, however, to remark, that independently of the labors of these several chairs, they are also among the most industrious and zealous workmen in the committees that have charge of the Journal, and of the scientific investigations, and that the pecuniary compensation which the Institute has hitherto been able to allow them, is far below what such services would command as private teachers, or examiners.

The library is now very extensive in books and periodicals connected with the history and progress of the arts and sciences, and a sufficient quantity of belles lettres literature is to be found in this department, for mental relaxation, when the more technical subjects become oppressive. The cabinet of minerals, models, and specimens of arts and manufactures, are steadily increasing, and they would, doubtless, improve more rapidly had the institution the means of more suitably providing for the display of such objects. The Journal has been, for almost twenty years, regularly recording the great discoveries of the day, whether made in this country, or in Europe; and is believed to be the only work now extant containing a list of all the American patents. The investigations in practical science that have been made originally by the Committee on Inventions, and more recently by the Committee on Science and the Arts, are only equalled by the works of commissions which have from time to time been instituted in Europe, and paid for out of the public treasury; while, in our case, the personal services have been entirely gratuitous, and in several matters of great importance in a national point of view, the only aid furnished, either by individuals interested, or the public authorities, has been the necessary outlay for materials, or apparatus. Whenever the Institute has been called upon for information by the municipal, state, or national, governments, the task has been cheerfully undertaken, and faithfully fulfilled; and although the recommendations thus made have been sometimes postponed for a season, they have, in the sequel, generally been put in practice when the routine of old methods had failed to satisfy the demands of the public voice. We forbear, for the present, speaking of the results of our exhibitions, for we desire to pause for a moment to ask at what cost has all this been accomplished.

We cannot, of course, measure the value of the time thus given by any pecuniary standard, but we mean to speak now merely of the amount of money that has been received from members, and in ordinary donations.

The conductors of the richly endowed establishments of Europe, will, no doubt, smile when we tell them that it is less than an average of six thousand dollars a year, or, in other words, that for six cents a week every man in our community may have access to a library and reading room well filled with newspapers from all parts of the Union, with the literary and scientific periodicals of the American and European press; may attend at least sixty lectures annually on the most important branches of physical science; may enrol himself either as a learner, or laborer, on any, or all, of the committees having charge of the cabinets, or of scientific examinations, and if he be willing to pay two cents a week more, he can enable his son, or apprentice, to participate in the principal of these advantages. It is not my province now to ask for aid to keep up our courses of instruction, cabinets, library, journal, and committees; these, we fear not, will always have the popular sympathies and support; but it is my painful duty to tell you that our Institution is laboring under the weight of a debt contracted under the most flattering hopes, but made a grievous burthen by a disastrous change of times. Anxious to meet the wishes of its members for enlarged accommodations, the Society was induced to purchase a valuable property in the city at what was considered a reasonable price.

Payments to the amount of about forty thousand dollars for account of the principal and interest of the sum thus contracted for had been made, when, owing to our inability to meet the interest, and maintain our organization, we were compelled to give up the property, and sacrifice, totally, this great amount. By the liberality of several of our citizens, we have been released from portions of the indebtedness represented by this loss; but there still remains enough to crush us utterly if we cannot, in some way, obtain the surrender of the certificate of debt. In addition to this, we owe still a part of the debt contracted in the year 1824, for the purchase of the site, and the erection of our Hall, so that with these obligations, our path for the last five years has been beset with difficulty and trouble. A generous, active sympathy, on the part of our members and fellow citizens, would soon relieve us, and we now make an appeal for it. Cannot five hundred men be found in this city and state, who feel a sufficient interest in the success of the Franklin Institute, who are willing to give one hundred dollars each to such an object. Relieved from the pressure of debt, we could repay such an outlay thrice over, by enlarging our plans for giving instruction; and who is there among us, elevated as he may be by the possession of wealth and station, who can look far enough into futurity, to say, neither my son, nor my son's son, will ever be an apprentice, or need the aid of such an institution as our own. The last sixty years have taught us many emphatic lessons on this head. The present king of the French has within that period supported himself by the labor of his own hands; the rich and noble of Europe, driven from their homes and possessions by the arms of a successful soldier of fortune, have become artizans, agriculturists, and manufacturers, while men like the merchant and mariner of our own city, have, during the same eventful period, risen from obscurity, and stamped their names indelibly on the page of history. I, therefore, earnestly press the claim of the Institute upon the rich and liberal, and trust that it will not be received with cold indifference. But we part from this theme to turn our attention to a more pleasing one—in the displays with which we have been periodically greeted at our exhibitions, we have recognized the fruits of our labors and efforts to diffuse useful knowledge among our mechanics and manufacturers. Year after year we have witnessed the march of improvement, and the collection of useful and ornamental articles by which we are surrounded, compared with the humble collection that we first displayed in the Carpenters' Hall, furnishes us with just cause for present gratulation. We must not, however, be satisfied with what we have attained; we are almost annually reminded, in tones from abroad that cannot be unheeded, of what is doing there. Many of you have doubtless read the graphic accounts from the French press, of the great exposition of arts and manufactures lately held in the city of Paris, at which the hands of royalty itself distributed the prizes, and proclaimed the honorable distinctions that had been earned by the citizens of the great empire. There the display was measured by miles, here we feel content to estimate it by feet, and although the republican simplicity of our manners and customs may not seem in harmony with such magnificence, yet our proper feelings, as part of a nation that yields to none in the world in natural advantages, would suffer no very severe trial if such a record could pass to our posterity as part of the history of the nineteenth century. If the proper spirit be once aroused among us, the accomplishment of this would not be difficult; in works of internal improvement, and the mechanics connected with them, we are perhaps in advance of Europe; in the possession of popular government, regulated by the will of the people, and in the regulating and controlling that will, we are doubtless more highly favored than they. We fail, however, in a comparison with them in the monuments and associations of ancient times, which engender a patriotic spirit of a peculiar cast, and lead them to undervalue that which is new and rapidly progressive.—Watched as we are by such jealous eyes, and viewed from abroad with more suspicion than favor, let us put off the self-satisfied spirit which is too often the stumbling block in the path of improvement and happiness. While we have youth and energy as a nation, let us lay broad and deep the foundations for social happiness and national independence and honor. Let us cherish those institutions, which, founded upon an equal regard to the rights and necessities of all, are attending to the great work of educating our people; not educating them in narrow and imperfect views of their duty to God, their neighbors, and themselves, but in a noble and catholic spirit, fitting them for any emergency that may arise in the republic.

As we have regard to such principles in what we are doing in our day, so will our career as a nation be distinguished. The false distinctions that ignorance makes between individuals, will disappear, and instead of the sneer of the miscalled practical man at the philosopher, we shall find philosophy and practice so intimately blended in the same man, as to cause the mind to doubt whether the prejudice to which we have referred could have ever really existed. The philosopher whose name distinguishes our institution, was a noble example of the union at which we aim; unaided by such lights as now shine upon the pathway of the student, he may be said to have first formed *the tools*, and then with them wrought himself up to the stature of immortality.

To the youth of our day we recommend the example of Franklin, in fitting himself by study and self-discipline to be a teacher and model for the world. To the rich we point his admirable practice of the lessons he had learned; and to all we say in the language of the great and learned teacher of wisdom,—"Happy is the man that findeth wisdom, and the man that getteth understanding, for the merchandize of it is better than the merchandize of silver, and the gain thereof than fine gold."

AMERICAN PATENTS.

List of American Patents which issued in May, 1844, *with Remarks and Exemplifications. By* Charles M. Keller, *Examiner of Patents.*

1. For an improvement in the *Horse Power;* A. D. Childs, Rochester, Monroe county, New York, May 6.

This horse power, like many before it, is on the general principle of the sun and planet movement; motion is communicated to a central vertical shaft provided with a mitre wheel near its lower, and a pinion near its upper end, the former driving the line shaft, and the latter receiving motion from three planet wheels arranged at equal distances around it, and each provided with a pinion on its arbor, the teeth of which take into cogs on the inner periphery of a permanent ring. The planet wheels turn on, and are carried around the central shaft by studs projecting downwards from a cap plate, (so formed as to make an entire covering to the whole machine,) which is guided and kept steady in rotating by means of rollers that embrace a flanch projecting from the outer periphery of the permanent ring, and others which bear against the inner periphery of the ring—the central shaft having its upper bearing in the centre of this cap plate.

Claim.—"What I claim as my invention, is the method of sustaining the upper end of the centre shaft, and guiding the pitch of the planet wheel pinions by means of the cap, as described, which is guided by rollers on the studs of the cap, under the planet wheels, bearing and rolling on the inner periphery of the planet ring, by means of which a stationary centre is dispensed with, and the wheels are protected."

2. For improvements in the apparatus for manufacturing *illuminating Gas, and for mixing it with measured quantities of atmospheric air, &c.;* James Crutchett, a subject of the queen of Great Britain, and now residing in Cincinnati, Ohio, May 6.

Claim.—"I claim the combining of two, or more, drums on the same shaft, so that they shall revolve together in a suitable case, or vessel, containing water, in the same way with the drum of the ordinary gas metre; one or more of which drums are so arranged and combined as to draw in atmospheric air, oxygen, or air and vapor, to be mixed, in measured proportions, with carburetted hydrogen, the proportionate quantity of each being governed by the capacity of the respective drums, upon the principle set forth. I claim the combining with the atmospheric air, previously to its mixture with the carburetted hydrogen, a portion of the vapor of naptha, spirits of turpentine, or other suitable inflammable liquid, whether this combination be effected by means of an apparatus constructed precisely as herein described, or in any other way in which the same end is attained; I do not claim the combining of atmospheric air with the vapor of hydro-carbons, when such combination is intended to be applied immediately to the purpose of illumination, without a subsequent combination thereof with carburetted hydrogen: my claim in this particular having reference solely to the production of a triple compound of air, vapor, and gas, with which to supply the burners; by which combination also I effect great economy in the production of artificial light. It is here to be clearly understood, that I do not claim as of my invention, the case furnished with trays to contain naptha, or other volatile liquid, for, although I have introduced some improvements therein, it is not new in its general arrangement. I claim the manner described of regulating the supply of oil, or other fluid, or fused matter, from which gas is to be made; the rising of the gasometer being made to close, and its descent to open, a cock, or valve, by which such supply is governed. I claim combining with the dipping box the vent tube proceeding from the cock, as set forth, for the purpose of drawing off the volatile oil, without allowing of the escape of gas."

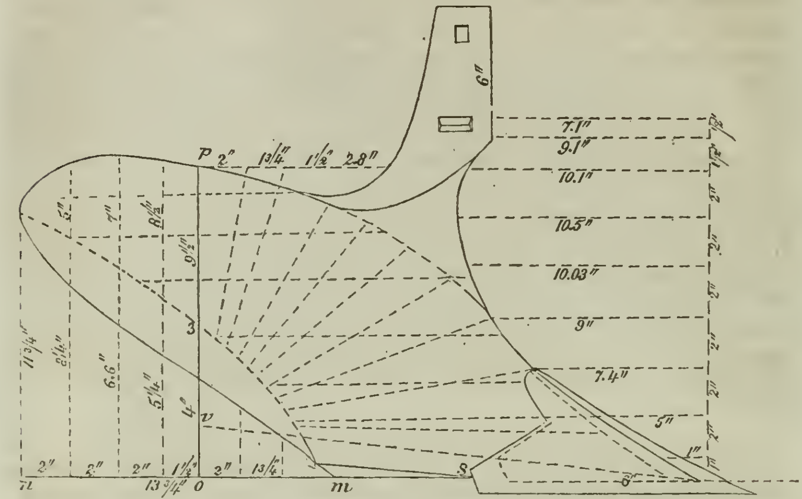
3. For an improvement on the machine for *computing Interest, measuring Lumber*, and for other similar purposes; Jehu Hatfield, Glenn's Falls, Warren county, New York, May 6.

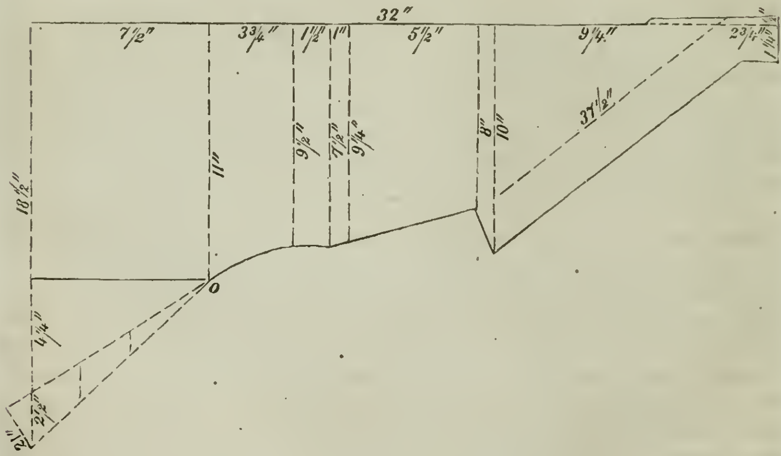
This machine consists of a vertical revolving cylinder, having on its outer surface vertical parallel columns of figures, or signs, representing the interest on the several sums shown in a stationary column on a surrounding case. There is also a circular scale, or dial, placed in front of the case in a vertical position, to indicate the days of the month, with an index hand, or pointer, which is operated by the cylinder—the two being connected together by mitre wheels.

Claim.—"In the old revolving interest tables," says the patentee, "there was a cylinder containing the interest, having the days and months stated at the head of each column, (instead of a dial and pointer,) enclosed in a round paste-board case, or box, having an opening in front with the principal pasted on one side; the cylinder being made to revolve by turning the shaft at the lower end with the fingers; and, therefore, I wish it understood that I make no claim to any part of this arrangement, but what I do claim as my invention, and which I desire to secure by letters patent, is the before described combination of the revolving cylinder, containing the vertical columns of numbers indicating the interest, with the permanent vertical scale showing the principal, and the dial representing the days and months, for which the interest is to be ascertained, and the pointer operated in the manner and for the purpose set forth, or in any other mode substantially the same, by which analogous results are produced."

4. For an improvement in the *Cast-iron Plough;* Aaron Smith, Bloomfield, Oakland county, Michigan, May 6.

The accompanying diagram and claim will give the reader a clear idea of the improvement patented, viz.,—"What I claim as new, and desire to secure by letters patent, is the particular manner in which I





form the face of the mould-board, as set forth; that is to say, by taking a radiating point in the particular position, designated in the drawing by the letter *v*, in the perpendicular line *o*, *p*, and at a height above the plane of the sole of the plough, such as is herein designated, and from *v*, as a centre, so forming all the radiating lines between the point *v*, and the upper end of the perpendicular *p*, as that a straight edge shall touch the face throughout the said range; the lines between the perpendicular, and the end of the board, being straight, and inclined over, as described, and the lines of the face of the mouldboard parallel to its base also being straight as set forth."

5. For an improvement in the apparatus for *Distilling Grain;* Benjamin Roop, Mount Pleasant, Westmoreland county, Pennsylvania, May 6.

The mash tub is to be surrounded by a jacket at such distance from the bottom and sides as to leave a chamber into and through which steam, or water, is to be conducted for the purpose of heating, or cooling, the mash.

Claim.—"I do not claim the mode of heating and cooling by a steam, or water, jacket; but what I do claim, is said water, or steam, jacket, in combination with a mash tub and mash rake, for the purpose of heating and cooling the mash."

6. For an improvement in the mode of *Setting Logs on Saw-Mill Carriages;* Benjamin Webb, Warren, Herkimer county, New York, May 6.

The slide of the tail block projects beyond the side of the carriage, and is there provided with a roller, which, as the carriage is run back, comes against an inclined guide, by which it is pushed with the log on it; and, for the purpose of keeping up this action, the inclined guide is attached to a slide which is, at each forward movement of the carriage, drawn towards the carriage a distance equal to the thickness of the plank to be sawed, and there held by a pall, on the slide catching in the teeth of a rack on the floor below the slide. The moving of the slide is effected by an arm that extends from and beyond the end of the tail block slide, provided with a latch, which, on the forward movement of the carriage, acts on the back face of a bevel attached to the plate of the inclined guide, and back of it; this bevel is made adjustable for the purpose of regulating the thickness of the log to be sawed, and the catch is jointed, so that, on the return of the carriage, it may pass over the bevel.

Claim.—"What I claim as my invention, is setting the end of the log by causing the end of the slide upon which the log is dogged, as the carriage is gigged back, to come in contact with an inclined guide, which is again moved laterally towards the carriage the required distance for another and similar set, as the carriage advances towards the saw, by means of a latch, or other similar appendage, in contact with an inclined gauge, or adjustable bevel, attached to the slide carrying the aforesaid guide, in which position the said inclined guide and gauge are held by a pall attached to the said slide dropping into a rack fixed on the frame of the mill, or other suitable place, and this method of setting the log I claim, whether it be effected by the combination of parts above set forth, or any other, substantially the same for producing like results."

7. For an improvement in *Wrought-Iron Wheels;* James McCollum, Wilsonville, Shelby county, Alabama, May 6.

Claim.—"What I claim as my invention, is the described mode of uniting the hub and the spokes, by making the latter embrace the former, instead of being inserted as heretofore done, by which arrangement the connexion between the hub and the rim of the wheel is stronger, and the hub is less liable to bend out of the central line."

8. For a mode of *Catching Moles;* Thomas Shailer, Haddam, Middlesex county, Connecticut, May 10.

A number of pointed wires are attached to a sliding board, with their points downwards, and to the upper part of the slide there is attached a cord, which passes over a roller, to hold up the slide with its teeth, or wires, and having its other end provided with a fly lever, connected by means of a notch with one end of a trigger lever, the other end resting on the surface of the ground, so that the moving of the earth by the mole shall liberate the fly lever, and permit the slide with the pointed wires to fall on to the mole.

Claim.—"What I claim as my invention, is the manner in which I have combined the lever, one end of which is to rest on the ground, with the sliding board, and the pointed wires with each other, and with the other parts of the trap, so that the raising of the ground by the mole shall cause the wires to descend; the respective parts being arranged substantially as described."

9. For an improvement in the machine for *Planting Rice and other Grain;* Richard I. Gatling, Murfreesborough, Hartford county, North Carolina, May 10.

In this machine there is a horizontal roller with channels, or grooves, in the direction of its circumference, and at distances apart equal to the space between the furrows; above this is placed a hopper, with a leather bottom, resting on the roller, and having a hole for each channel, through which the rice, or other grain, passes into the channels, by which they are carried down into inclined spouts, that discharge them in the furrows, prepared by teeth, forward of the inclined spouts.

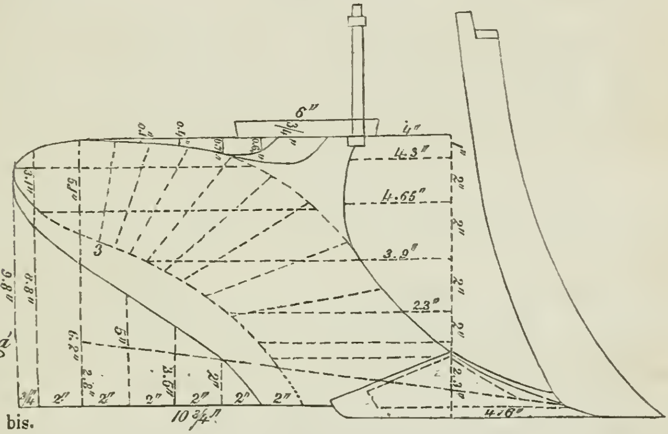
Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of the perforated hopper, revolving channeled cylinder, and inclined conductors, as described."

10. For an improvement in the *Double Plough;* Aaron Smith, Bloomfield, Oakland county, Michigan, May 10.

This is termed by the patentee, the "Double Sub-Soil Plough:"—"It has two mould-boards, and their proper appendages, placed one before the other on the same beam; the hind plough being so proportioned and arranged as to raise and lay its furrow slice on that of the forward one." The forward plough is smaller, and does not cut so deep as the hind one.

Claim.—"I do not, in this patent, make any claim to the manner in which I attach the land-side and mould-board to each other; nor do I herein make any claim to the particular manner in which I form the face of the mould-board; nor do I claim the placing of two mould-boards upon one beam; nor the causing of the rear plough to throw its furrow slice upon that of the fore plough, these having been effected by a plough for trenching; but having ascertained by varied experiments, that not only the special form of the outline of the two boards in their relationship to each other, as well as that of the turn of their surfaces, are points of great importance, I do claim the special form given to the two boards in their outlines, as designated by the numbers on the vertical and horizontal lines in figures 8 and 15, and on the lines showing the width in figures 7 and 14, (see accompanying diagrams;) these numbers, however, being taken as relative, as the size of the whole plough may be varied. It will be manifest, that in making this claim I cannot intend that these measurements should be taken with mathematical exactness, but that the outlines and proportions should be substantially the same with those set forth. I claim the particular form given to the heel of the hinder mould-

Fig. 8.



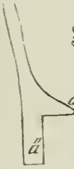
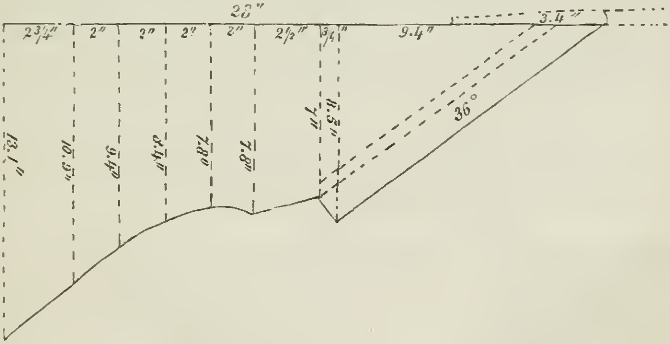


Fig. 8 bis.

Fig. 15.



board, as shown by the triangular space *a'*, *s*, in fig. 8, and the hind view of this part in fig. 8, bis, by which form the slice deposited by the fore plough is left undisturbed, and that cut by the hind plough is raised preparatory to its being deposited upon it."

Fig. 7.

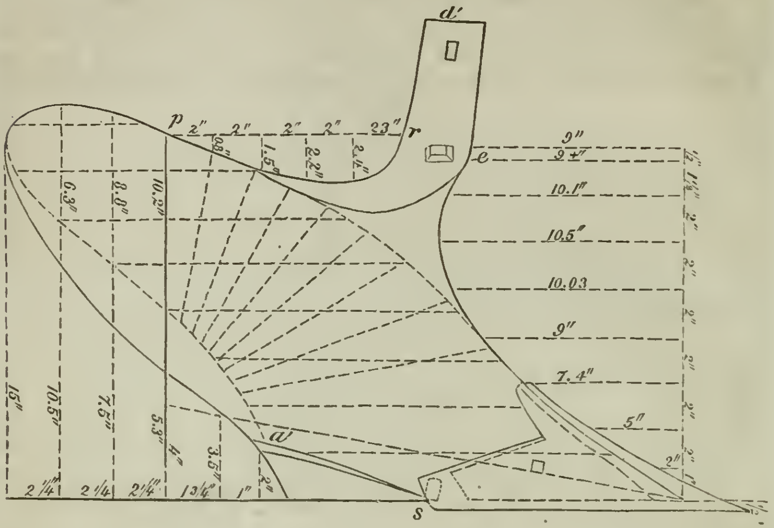
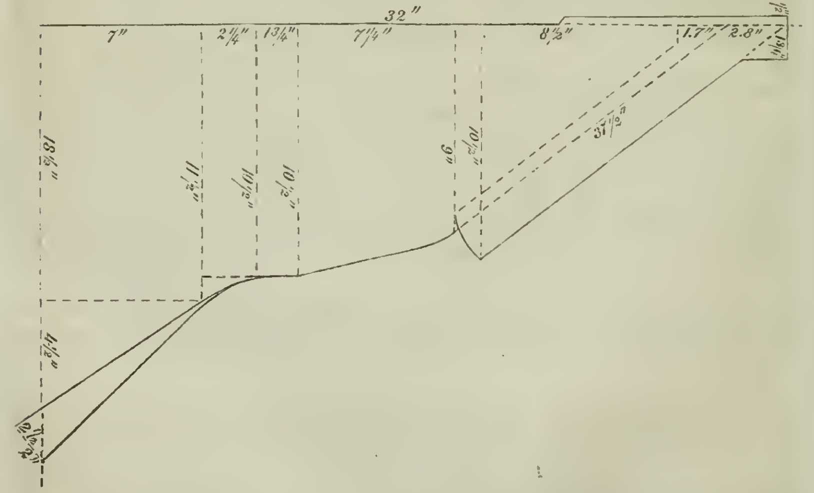


Fig. 14.



11. For an improvement in the *Caps of Hand Lamps;* Robert H. Eddy, Boston, Massachusetts, May 10.

This is for an improvement on an oil feeder and lamp cap, patented by Joseph Benson, on the 28th of February, 1844, and noticed in this Journal at page 245, of volume viii, 3rd series, to which the reader is referred, to enable him fully to understand the improvement set forth in the following—

Claim.—"I shall claim the combination of a cup, or receptacle, with the chamber, the object of the said cup being to catch any carbon which may drop from the inflammable portion of the wick; also the addition to, or combination with, the cap of the inclined lip surrounding the exterior edge of it, and extending from and above, the object of the said lip being to prevent any oil, or carbon, that may be in the cup, from running over and dropping on the outside of the lamp whenever the lamp is turned over into a horizontal, or inclined, position; also making the chamber entirely within the collar, or neck, in combination with a lip raised upon the upper edge of the collar; the object of such an arrangement being to arrest any oil which may escape through the screw of the lamp cap, or between that formed upon the exterior of the chamber, and the interior of the collar: the whole of the above being constructed and operating substantially as specified."

12. For an improvement in the method of applying *Water, or Animal, Power as a motive force;* John A. Wiszt, Philadelphia, Pennsylvania, May 10.

The general principle of this device is well known, and has often, in by-gone years, been patented, and abandoned as often as essayed. It consists of an inclined wheel on a horizontal shaft, so connected with it, as to be capable not only of changing its inclination relatively to the shaft, but of causing any part of its circumference to assume the lowest point of the inclination, whilst the shaft remains vertical, so that a weight, whether water, or animal, or any other ponderous body, traveling around on the wheel, will cause every portion of its circumference in succession to descend to the lowest point, without rotating the wheel, and thus causing the shaft, which passes through an enlarged and flat hole in a cylinder, that turns freely in the hollow hub of the wheel, to rotate.

The claim is limited to the manner in which the connexion between the wheel and shaft is formed, and as it refers to, and is wholly dependent on, the drawings, we are under the necessity of omitting it.

13. For an improvement in *Life Preservers;* Callistus Augustus De Liancourt, Paris, France, assigned to Joseph Francis, of New York City, May 10.

We deem the insertion of the claim sufficient to enable the reader fully to understand the character of this improvement.

Claim.—"What I claim as my invention, is the making of life preservers, buoys, rafts, and other articles for buoyant purposes, by distending the air bag with a helical spring, or with separate hoops, or rings, of iron, or other metal, whalebone, or any kind of wood, covered with any suitable, or proper flexible, material, and in combination with this the mode of making and attaching ends of any proper material, one of which is provided with a valve, by which arrangement the permanent elastic force, or stiffness, of metal, or other material, used for distending the bag, is substituted for the uncertain elastic force of air, substantially in the manner described."

14. For an improvement in the machine for *Cutting Crackers, &c.;* John Johnson, and Otis Freeman, Boston, Massachusetts, May 17.

Claim.—"We shall claim causing the cutter frame with the cutters, after the impression has been given upon the dough, to move away from the inclined bed, or apron, over the bed, and leave the scraps and waste dough upon the apron, or bed, and to drop the crackers, or biscuits, upon a shelf, or other suitable receptacle separate from the apron, or bed, all in the manner as above set forth; the said shelf, cutters and apron being constructed and operating substantially as set forth; also the mechanism by which the cutter frame is operated and turned from a horizontal position to an inclined one, the same consisting of the curved bar, and horizontal bar, in combination with the mechanism which draws the cutter frame towards the inclined apron, or bed; the whole being constructed and arranged as set forth."

15. For an improvement in the *Washer, for cleansing Satinets and Woolen Cloths;* William Soule, Stafford, Tolland county, Connecticut, May 17.

This is for an alleged improvement on the washer, which consists of two rollers; the box in which the rollers work is divided into two compartments, an upper and a lower one, by a partition perforated with holes, for the passage of the cloth, and others provided with valves to retain the suds in the upper, or permit it to descend into the lower chamber.

Claim.—"What I claim as my invention, is the application of the partition and valves for the upper suds chamber, with the cocks for drawing off the suds, when retained in the upper chamber, to the washer described and set forth."

16. For an improvement in the *Cooking Range;* Herbert H. Stimpson, Boston, Massachusetts, May 17.

Claim.—"I do not claim the introduction of the smoke, heat, or other volatile products of combustion, to the sides of an oven of a cooking range through lateral flues proceeding from the boiling chambers, or space under the boilers; but that which I do claim consists in the manner of arranging the flues which proceed from the boiling chamber and fire place, and pass in contact with the oven, so as to equally, or thoroughly, distribute the heat over the exterior of the oven, and permit the operations of baking and boiling, to be carried on without shutting off, or interrupting, the communication between the fire place and flue space beneath the oven, and around its sides; the said arrangement consisting in carrying the lateral flues, or those proceeding from the boiling chambers, directly against the front parts, or halves, of the sides of the oven, and thence horizontally over, and in contact with, the top thereof, and opening the same at the top of the oven into the discharge flues, as described, in combination with carrying the main discharge flue of the fire place beneath, and in contact with the oven, and around and in contact with the rear parts, or halves, of its sides and top, the same being connected with the discharge flue leading to the chimney, and the whole being substantially as set forth."

17. For an improvement in the *Smut Machine for cleaning Wheat, &c.;* Henry B. James, Mount Holly, Burlington county, New Jersey, May 17.

This machine is a modification of that class of smut machines which have been extensively used, and which, therefore, have been the prolific source of improvements, or modifications, and hence of patents. It consists of a set of beaters, or fans, on a vertical shaft within a case, through which the grain passes to receive the action of the beaters, or fans, and of an upward current of air produced by the action of the fans. In this instance, the case is conical, and fluted on the inside, and the beaters, or fans, are constructed in a manner fully expressed in the subjoined claim. The top of the case is provided with a spiral flue, or trunk, through which the grain passes into the machine, and where it is acted upon by the current of air before it reaches the beaters, or fans.

Claim.—"What I claim as my invention, is the arrangement of the circular trunk, as described, to conduct the air, and float out foreign matter from the machine, and the fans constructed of two, or more, sets of leaves, or plates, arranged one above another on a common shaft, said plates being placed diagonally upon said shaft, and arranged so that the leaves of one tier shall break joints with those above them, to act upon the grain, in combination with a stationary inverted cone, roughened on the inner surface by slight flues, or otherwise, and to produce a current of air through the machine, as described."

18. For a *Harrow, or Sward Cutter;* Dennis Rice, Rowe, Franklin county, Massachusetts, May 17.

The teeth of this harrow are arranged in the usual manner, in a triangular frame, but, instead of being straight and pointed, they are bent back in a segment of a circle, with the front edge sharp, to cut the sward.

Claim.—"What I claim is the mode described of constructing the sward cutter harrow; that is to say, by using and combining with the harrow frame a suitable number of movable harrow teeth of the above description, for the purpose specified."

19. For a *Revolving Rule,* for measuring surfaces, and particularly applicable to lumber; Charles Ross, Piqua, Miamia county, Ohio, May 17.

A wheel, of one foot in circumference, is so arranged in a case, as to have a portion of its periphery project beyond the case, and a portion of its face visible through a hole, the edge of which is graduated to correspond with concentric circles on the face of the wheel, graduated in the manner of the common lumber rule. The shaft of this wheel is geared with the shaft of a cylinder, so that the latter will make one revolution to thirty-six of the former, there being thirty-six divisions to indicate the number of revolutions made by the wheel; and the shaft of this cylinder is geared with another cylinder, which makes twelve revolutions to one, to mark the number of revolutions made by the first cylinder. The scales on the wheel and cylinders are so arranged as to give the superficial as well as the running measure.

Claim.—"What I claim as my invention, is the combination of the common board rule with the self-calculating cylinders, and their combined application to the measurement of plane surfaces in general, but more particularly to the measurement of the superficial contents of boards, plank, and lumber."

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20. For an improvement in *Lamps;* Henry B. Fernald, Boston, Massachusetts, May 17.

In this lamp there is an annular distributing reservoir some distance above, and communicating with the burner by a tube, (designated in the following claim by the letter *a*,) and by another tube (*b*,) with a hand pump, in a main reservoir in the pedestal of the lamp, by which the oil is forced up into the distributing reservoir. There is another tube to discharge the surplus oil from the distributing reservoir, and the tube (*a*) that supplies the burner, into the main reservoir—the tube (*b*,) for these purposes, extending to the upper level of the distributing reservoir, and communicating by a hole with the tube (*a*)at, or near, the level of the burner.

Claim.—"I claim the apparatus added to, and combined with, the burner, and the main reservoir, for the purpose of maintaining the oil in the wick case at a constant level, with respect to the wick; the same consisting of the distributing fountain, and tubes (*a* and *b*) proceeding therefrom, and opening into, or communicating with, each other, (at the level, or about the level, of the top of the burner,) and with the column, or reservoir, as before set forth; the whole being arranged and operating in connection with the burner and fountain beneath the same, substantially as specified."

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21. For an improvement in the *Smut Machine for cleaning Grain;* Abraham Straub, Milton, Northumberland county, Pennsylvania, May 17.

"The nature of this invention consists in forming an involuted conductor for the grain, from the centre to the periphery, under the fan upon the runner, at which point it is subjected to the action of the beaters, and wind from the fan at the same time, and is cleaned of all the loose dirt and smut as fast as it is broken.

Claim.—"What I claim as my invention, is constructing the runner in the manner set forth, having involuted conductors on it, intersected at the periphery by beaters, and surmounted by a fan; the whole being arranged substantially in the manner and for the purpose specified."

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22. For a machine for *Trimming the ends of Bristles in making Brushes;* Samuel Taylor, East Cambridge, Middlesex county, Massachusetts, May 17.

The brush to be trimmed is placed on two guide rails made adjustable, to regulate the length of the bristles; and below this is a plate with V shaped teeth, made sharp at the sides, and below this, and in contact with it, there is a rotating cutter, which acts in connexion with the teeth, in the manner of shears, to cut the surplus length of the bristles.

Claim.—"I claim the apparatus, or means, of receiving and holding the bristles to be cut, (the same consisting in a series of teeth, &c., extending from a plate, and having their edges, or sides, sharpened as described,) in combination with one, or more, revolving, or movable, cutters placed directly beneath the said teeth, and arranged and caused to pass in contact, or nearly so, with them, so as to act in connexion therewith, similar to scissors, or shears, and cut, or separate, those parts of the bristles extending below the teeth from the remainder, or parts above them, and thereby reduce all the bristles of the brush as set forth; and I also claim the combination, with the above, of the mechanism for holding, or guiding, the block, or brush, or presenting the bristles to the cutters and teeth, in such manner as to cause them to reduce, or cut, the said bristles to a regular, or requisite, length; the said mechanism consisting of the adjustable rails, or guide bars, arranged over the cutters and teeth, and in connexion therewith substantially as described."

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23. For an improvement in *Awnings for the front of shops, &c.;* John Sebo, Wilmington, Delaware, May 25.

This awning is attached, by its upper end, to a roller having its bearings in staples attached to the house, and its other end to a pole, and from this pole a set of sustaining cords extend over the awning around the roller next the house under the awning, and thence around a roller on posts at the edge of the walk; and below this, and revolving with the same velocity, there is another roller, on which wind another set of cords. The first set of cords not only sustain the awning, but, by winding on the roller at the top of the posts, answer the purpose of rolling it up on the roller next the house, whilst the second set of cords unroll it—the two sets rolling and unrolling on the two rollers, which have for this purpose equal velocities.

Claim.—"What I claim as my invention, is sustaining the roller, next the house, by means of a cord passing over pulleys, and winding up with the cloth, conducted in the manner and for the purpose set forth; I also claim, in combination with the awning, the rollers, one for the awning, and the other for the sustaining cords, as described."

24. For an improvement in *Oil Boxes for preventing journals from heating;* Elisha Reid, Columbus, Georgia, May 25.

Claim.—"What I claim as my invention, is the prevention of heating journals and boxes, by surrounding the boxes with a reservoir of water, in such manner as to prevent the access of water to the oil box and journals, as described, thereby preventing heat, and, consequently, the drying away of oil, and wear of the rubbing surfaces, and the necessity of frequent oiling, using for the reservoir any material suitable, and any composition of metal for the bearings."

25. For an improvement in the process of *Converting Iron into Steel;* Simeon Broadmeadow, New York City, May 25.

The patentee says,—"My improvement consists in the using of a permanent roof of fire stone, or fire brick, in place of the temporary covering heretofore employed. I also use a sliding shutter, which is placed in front of the furnace, so that it may be brought down as required. My improvement in the manufacturing of the steel, after the process of cementation has been completed, consists in the taking of the bars first from the upper part of the convertory, whilst they are at the highest temperature to which they are to be brought, and subjecting them immediately to the action of tilting, or of rolling, without the necessity of reheating. To do this, a part of the upper layer of bricks, which enclose the converting oven, is first removed, so as to enable one to draw out the upper bars, and as the bars are successively operated upon, the bricks are further removed, until the whole contents of the convertory have been tilted, or rolled. As this process goes on, the sliding shutter is brought down, so as to enclose the part from which the bricks have been removed. By this procedure several advantages are attained in the process of manufacturing steel. Under that hitherto followed, the whole charge has been allowed to cool down before removing the steel from the convertory, and this necessarily resulted in great loss of time; the bars after being removed, had to be reheated, in order to their being tilted, or rolled: by this reheating time was consumed, and the steel actually injured, it being a well established fact, that every time steel is highly heated it is deteriorated."

Claim.—"What I claim as new, is the improvement herein described, of taking the steel from the oven in its heated state, and subjecting it to the action of rollers, or of the tilt hammer, without the necessity of reheating the bars; by which improvement said manufacture is greatly facilitated, and the quality of the steel much improved."

26. For improvements in the *Engine, to be actuated by Inflammable Gas, or Vapor;* Stuart Perry, New Port, Herkimer county, New York, May 25.

"In my inflammable gas, or vapor, engine," says the patentee, "the power which is to be obtained from it for the driving of machinery, is to be produced by the expansion consequent upon the combustion of vapor of spirits of turpentine, or of other evaporable inflammable liquids, or of gas, or vapor, or gas and vapor combined, obtained from undistilled turpentine, or from rosin, or such other substance as will produce inflammable vapor, carburetted hydrogen, or other inflammable gas, by the aid of atmospheric air, within a cylinder similar to that used in the steam engine. It is well known to engineers, that various attempts have been made to generate power by the combustion of explosive compounds within a cylinder; the expansive force of such compounds, when ignited, being in some cases allowed to act directly upon a piston, whilst, in other cases, the compounds have been exploded for the purpose of obtaining a vacuum, into which the piston might be forced, by pressure induced on the other side of it; but such attempts have not resulted in the production of a machine which could be practically used with advantage."

Claim.—"What I claim is the manner in which I have combined and arranged the air-pump, the reservoir, the retort, the air regulator, and the cocks which govern the admission of atmospheric air into the valve box, and their appendages, as described; by which arrangement I am enabled to supply the inflammable gas, or vapor, in regulated proportions, and to produce a pressure within the cylinder slightly exceeding that of the atmosphere, at the moment of opening one of the ignition orifices, which outward pressure is to be immediately succeeded by a draught inwards, this being effected in the manner and for the purpose described. I claim also the manner set forth, of heating the retort, by employing the heated air which escapes through the eduction tubes, so as to render such air effective in converting the combustible fluid employed into vapor."

27. For a combination of matter constituting a *Cement, or Pigment, to prevent the oxidation of metals, and as a protection against moisture and fire;* Edward Deutsch, France, May 25.

[See Specification.]

28. For improvements in *Weaving Looms;* James Nield, Taunton, Bristol county, Massachusetts, May 25.

We are under the necessity of omitting the claims of this patent, as they refer to, and are wholly dependent on, the drawings which are necessarily complex and numerous. If deemed sufficiently important, the specifications and drawings will be given in a future number.

29. For an improvement in the machine for *Cutting Shingles;* Jonathan P. Bartley, Flanders, Morris county, New Jersey, May 25.

Two or more knives for cutting the shingles are affixed to the periphery of a hollow drum, with a flanch at each end; the shingles, after being separated from the bolt by the knives, pass through slots in the drum, which constitute the throats of the cutters, and are conducted out of the drum, and clear of the arms by curved guides.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the employment of the drum, in combination with the knives, for cutting shingles, and the curved guides for carrying off the shingles; the whole being constructed and arranged substantially as set forth."

30. For an improvement in the *Mill Bush;* Robert M. Wade, Summit Point, Clark county, Virginia, May 25.

The mill bush is enlarged to receive rings of leather packing, which surround the spindle, and rest on the bottom of the hollow bush; these are held down by a metallic piston forced down upon the packing by a screw cap; the oil chamber, for containing oil, &c., to supply the packing and spindle, is formed by a groove in the upper face of the piston, and a corresponding one in the under face of the cap screw; the former being provided with holes for the discharge of oil at the junction of the packing and spindle, and the latter with holes for pouring in the supply of oil.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the mill bush with an annular chamber, for containing the oil, or other lubricating substance, used for oiling the mill spindle, by making corresponding circular grooves in the bottom of the screw cap, and in the top of the piston, which thus answer the two-fold purpose of oil chamber and driver, for keeping the annular rings of leather packing, contained in the cylindrical cup, lubricated, and against the spindle, in the manner and for the purpose set forth."

31. For an improvement in the machine for *Mortising and Tenoning Timber;* Elbridge Lyman, Northfield, Franklin county, Massachusetts, May 25.

The chisel for mortising is attached to one end of what is called, in the specification, a head piece, attached by adjusting screws to the upper end of the slide usually employed in mortising machines for holding and carrying the chisels, and the two chisels for cutting tenons, to the other end of the said head, so that by simply reversing the head the machine can be employed for either purpose without the necessity of taking off one, and substituting another, set of chisels.

Claim.—"I claim arranging the two sets of chisels (tenoning and mortising) upon one movable and reversable head, instead of disposing them upon separate heads, in the usual manner."

32. For an improved mode of *Drafting, to cut garments;* Henry Isham, Montpelier, Washington county, Vermont, May 30.

This method consists of three measures, variously formed and applied to different parts of the body, with measuring tapes attached to them; but the form and general character of these could not be made clear without drawings of them, as applied to the body, which would carry us beyond the limits of this work.

Claim.—"What I claim is the combination of the three described measures for the purpose described; and also the first and third measures described for the use and purpose described."

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33. For an improvement on the *Scraper, for making and repairing roads;* Samuel G. Sutton, Yorkshire, Cattaraugus county, New York, May 30.

This scraper consists of a triangular frame composed of two side pieces hinged together at one end, and connected together at the other, by a clamp brace, that it may be made wider, or narrower, at pleasure. The lower edges of the side pieces are armed with iron. The team can be attached to staples on either side of the end hinge, as occasion may require the earth to be removed to one side, or the other, and when the earth is to be moved forward the team is to be attached to the wide end. There is a piece, called the gate, hinged to the back end of either of the side pieces at pleasure, and provided with a handle to enable the operator to change its position, as may be required."

Claim.—"What I claim is making the two sides of the scraper with a hinged joint at one end, and a clamp brace at the other, that the two sides may be separated, or brought nearer together, for the purpose and in the manner described. I also claim the gate, in combination with the scraper, for the purpose and in the manner described."

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34. For a process for obtaining *Malleable Iron directly from the Ore,* by treating the same in a puddling furnace; Simeon Broadmeadow, New York City, May 30.

Claim.—"What I claim as new, is the effecting of such reduction, (the reduction of the ore into malleable iron,) by mixing, in due proportion, the ores known as oxides, and as carburets of iron, (without the necessary admixture of fluxes, or carbonaceous matter,) and exposing them to a proper temperature, for fusing the same, in a furnace, so constructed that the flame shall not reverberate upon the mass, but shall pass over it in contact, or nearly in contact, therewith."

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35. For an improvement in *Propelling Steam-Ships, and other vessels;* Peter Von Schmidt, Washington, District of Columbia, May 30.

A wheel having naves in manner similar to a rotary fan blower, and a top and bottom plate attached to and moving with them, and extending from the ends of the naves to within such a distance of the shaft as to admit water to enter, is placed and works within a case in a recess in the vessel below the water line, and provided with tangent pipes leading and extending to the stern, bow, and sides of the vessel; these pipes are provided with shutters which can be closed and opened at pleasure. The rotation of this wheel produces a current of water, by centrifugal action, in, through the hollow centre, and out, through the tangent pipes of the case, so that by closing any of the pipes the vessel will be impelled in any desired direction.

Claim.—"What I claim as my invention, is the employment of a wheel enclosed in a case, as described, having tangent pipes leading forward, back, and out at the sides of the vessel, in the manner and for the purpose set forth, the whole being submerged in a recess in the vessel, and acting in any direction at the will of the engineer, without reversing the motion of the wheel, or in any way checking the engine by means of shutters, or gates, arranged as described."

36. For an improvement in the *Hemp Cradle, for cutting Hemp;* Griffin Reynolds, Jr., Washington, Mason county, Kentucky, May 30.

In this cradle there is a brace which extends from the end of the knife, or blade, along the ends of the fingers, (and attached to them) up to the top, and there bent over to form the upper finger. Instead of the finger board, used in Laramore's cradle, which runs up for some distance from the top of the knife, or blade, there is a round finger some inches above the blade, and connected with and braced to it by round screw studs, to prevent springing and clogging.

Claim.—"The said Griffin Reynolds, jr., claims, as his improvement on the Laramore cradle, the combination of the knife, constructed as described, with the front brace and space between the first finger and the knife."

37. For an improvement in machinery for *Dyeing, Sizing, or Impregnating, Woolen, Cotton, or other Yarn;* William A. Burke, Manchester, Hillsborough county, New Hampshire, May 30.

Claim.—"I claim the method by which I am enabled to effect the passage of the yarn from one set of squeeze rollers to the other, throughout the series thereof, without its receiving, during the same, more tension than is necessary to operate the stop motion; the same consisting in arranging and actuating each set of squeeze rollers, so that the yarn shall be passed by and between its rollers at a slower rate, or speed, than it does through the set immediately preceding, and applying a stop motion to the yarn, and each set of squeeze rollers, in the manner set forth; so that the slackening of the said yarn, between each two sets of squeeze rollers, shall throw the machinery, by which one set of said rollers is revolved, out of action, until the succeeding set is enabled to take up the surplus yarn; also the method by which the yarn (or coils thereof,) is protected from entanglement and friction, while passing and being wound several times around the various squeeze and dipping, or other, rollers, and steam cylinders of the mechanism, viz., by arranging the said rollers and cylinders in the angular positions, with respect to the general course of the yarn through the machine, or with respect to the frame work of the machine, as described; the whole mechanism being constructed and operating substantially as described."

It is only necessary to add that there are improvements in the kind of machinery used for this purpose in which the yarn is dipped into a succession of vats, passing from one set of rollers into a vat, from this up to a set of squeezing rollers, thence into another vat, and so on.

38. For an improvement in the machine for *Drilling Iron, or Boring Wood;* Amos Morgan, Wooster, Wayne county, Ohio, May 30.

The drill mandrel is driven by a cog-wheel on a shaft below, taking into a pinion on it; and the drill is fed forward by a nut on the screw of the mandrel—this nut is on a hand-wheel, and on one side of the hand-wheel there is a cog-wheel for the purpose of running back the drill, by means of a cog-wheel on the driving-shaft below it, and on the other side a face ratchet connected with a lever, which is actuated by an adjustable cam on the driving shaft. There is a piece jointed to the lever in such manner, that when the pall is in place it forces it against the ratchet, and, when thrown back, holds it from the ratchet.

Claim.—"What I claim is the screw and mandrel, constructed and combined in the manner described, in combination with, and driven and fed up to the work by means of a driving-shaft and spur-wheels, and adjustable cams thereon; the said cams driving the screw by means of the lever, pall, and ratchet, the shaft being moved in a lateral direction by the pinion on said mandrel; the whole being constructed, combined, and arranged in the manner and for the purpose described. I also claim the piece (for holding the pall,) in combination with the lever and pall for holding the pall to or from the ratchet wheel, as set forth."

Specification of Letters Patent granted to EDWARD DEUTSCH, *of Havre, France, for a composition of matter constituting a Cement, or Pigment, to prevent the Oxidation of Metals, and to be used as a protection against moisture and fire; on the 25th of May,* 1844.

Be it known, that I, Edward Deutsch, of the Kingdom of France, residing in the city and port of Havre, have invented a new composition of matter, and improvement in the preparation and combination of materials not known, or used, by others before my discovery thereof, and not, as I believe, now in use, or for sale, in these United States—certainly not with my consent, or allowance—yielding a production which will be found of general utility in its various modes of combination; among others, as a cement, or pigment, supplying the means of preventing the oxidation and deterioration of metallic substances, and of precluding the infiltration, or percolation, of fluids, and the absorption of dampness, or moisture, preserving from the injurious effects thereof, and even in some cases guarding against destruction by fire; which can be used with great advantage and economy, especially in all things that are wanted to be made water tight, in all edifices and constructions in which stone, wood, timber, earth, or metal, is employed; for vessels, steamers, steam and other engines, cordage, various tissues and textures, leather, and in general for materials used in various arts and manufactures. And in order to enable persons skilled in the arts, to make and use my invention, I will proceed to describe the materials employed therein, the mode and process of its composition, and its application.

The bases consist in all substances that are combustible, and not metallic compounds, such as bitumen, asphaltum, pisasphalt, maltha, mineral caoutchouc, and products obtained from the distillation of fossil coal.

Formula I.—Of the substances above described as bases, particularly bitumen, put any given quantity into the boiler of a still, prepared for the purpose; lute the apparatus, and heat it in such manner that the essential oil and water embodied in the bitumen shall, during the process of evaporation, be condensed by the cold water contained in the condenser, or cooler, of the worm; and at that point when the distillation produces only a few drops of liquid, sift the material which remains in the boiler through metallic cloth, or sieves, placed over a vessel of sufficient capacity, and containing water to prevent adhesion to the bottom, or sides; when it has been reduced to a temperature equal to fifty, or sixty, degrees centigrade, (122 to 140 Fahrenheit,) take the material out of the water, and mould it into lumps.

Formula II.—To the material prepared as per formula No. I, add from one to twenty-five per cent. of protoxide of lead, or of any other oxide, and you will obtain a substance more, or less, inflammable, according to the proportion of oxide which may have been used and fused together.

Formula III.—To the material prepared as per formula No. I, add from one to one hundred per cent., or more, of grease, or adipose, matter, and you will obtain a product more, or less, friable in proportion to the greater, or less, quantity of adipose matter used.

Formula IV.—To the material prepared as per formula No. I, add from one to one hundred per cent., of siccative oil, especially of linseed, and as much caoutchouc, or gum elastic, or mucilage, and you will obtain a paint, or pigment, peculiarly adapted to various textures, tissues, cloths, paper, &c., and leaving them perfectly flexible.

Formula V.—To make black varnish of great beauty, you must, after heating the bitumen until it has become liquid, sift it through very fine metallic sieves previously heated, and then add from one to one hundred per cent. of resin, or of resinous gum of any sort, then put the bitumen, thus prepared, over the fire, and leave it so until the essential oil and water contained therein shall be evaporated, then add spirits of wine, or oil of turpentine, or other of the same nature, until the whole be of proper thickness for use.

Sealing wax of great beauty can be obtained by following this (the VIth) formula, saving the addition of spirits of wine, or essential oil, which must be omitted.

This product mixed with saw, or marble, dust, or sand, or with the filings, or oxides of metals, &c., will answer to make walls, statues, vases, terraces, &c.

In all cases in which it is desired to give this product more, or less, flexibility, there may be added, besides resin and resinous gum, wax, and especially from one to thirty per centum of sulphur.—From the essential oil produced by the distillation of bitumen, there is obtained naphtaline in greater quantity, and of purer quality than by the distillation of tar, or pitch.

What I claim as my invention, and desire to secure by letters patent, is the combination of the materials prepared as per formula No. I, named in the foregoing specification, and other known substances of the same nature, with the various ingredients therein referred to, or other known substances of the same character, according to the different formulas set forth.

List of American Patents which issued in the month of October, 1841, *with Remarks and Exemplifications. By* Charles M. Keller, *Examiner of Patents.*

1. For improvements in the machine for *combing and preparing Wool, Flax, &c.;* Francis A. Calvert, Lowell, Massachusetts, October 9.

The patentee says,—"My first improvement consists in the manner in which I arrange the teeth around the revolving table, or disk, so as to cause the teeth to rise in a line with the periphery, or so that the circle generated by the revolution of their points, shall not be smaller than that of the periphery of the disk. My second improvement is in the manner of furnishing the combing cylinder, which I use instead of the wire teeth combing wheel employed by Wright & Hawkesley, and of the brush, or wire teeth, used by William W. Calvert. My third improvement is in the using of an endless belt above the combing cylinder, for the purpose of cleaning the fibres from the teeth of said combing cylinder, and of laying them in such manner as that they shall be ready to be received upon the teeth of the revolving disk. My fourth improvement consists in the causing of a current of air, or of steam, to be blown upon the fibres of wool, or other material, as they are delivered from the combining cylinder to the toothed disk, in order to prevent the hanging down of any of said fibres below the teeth, by which they would be prevented from being properly combed, and also in directing a similar blast in a horizontal direction against the combing cylinder, to prevent the fibres from lapping around said roller, and to lay them close on to the combing cylinder. My fifth improvement is the substituting for the apparatus called the universal sweeper in William W. Calvert's machine, a blast of air, or of steam, which is directed on to the fibres as they are about to pass from the revolving disk to the drawing rollers, thus causing them to be perfectly taken up by said rollers."

Claim.—"First, I claim, in combination with the combing cylinder of the machine herein described, the so arranging of the vertical teeth around the periphery of the revolving disk, as that the circle generated by the revolution of their points, shall not be less than that of the periphery of the disk, thereby avoiding the forming of a shoulder which will interfere with the near approach, and advantageous action of the combining cylinder, as set forth. Secondly, I claim forming the teeth of the combining cylinder of plates of metal, instead of from wires, inserted into a metallic strip, as heretofore practiced; said metallic plates being attached to the cylinder by screws, or kerfs, in the manner described, or in any similar manner which will avoid the formation of a shoulder, which has a tendency to become clogged, and thus interfere with the action of the machine. Thirdly, I claim the combining with the combing cylinder in a machine for combing wool, flax, &c., an endless belt made to revolve above said cylinder, in the manner and for the purpose set forth. Fourthly, I claim the blowing of a current of air, or of steam, in a vertical direction, through a flat tube, situated immediately below the point of action, between the revolving disk and the combing cylinder, for the purpose and in the manner set forth. Fifthly, I claim the employment of a similar tube and current directed horizontally over the top of the upper feeding roller, and against the combing cylinder, for the purpose made known. And sixthly, I claim the directing of a current of air, or of steam, against the combed fibres as they are passing from the revolving disk to the drawing rollers, for the purpose of elevating such portion of said fibres as might not otherwise be duly taken in between said rollers; the whole being constructed and operating substantially as described."

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2. For an improvement in the *Pump for raising liquids;* Henry Rogers, Auburn, Cayuga county, New York, October 9.

The object of this improvement is to enable one pump to serve for the raising of several kinds of liquid from a cellar, or other apartment, containing barrels, or other reservoirs, having in them the several kinds of liquid which are to be raised and delivered in a store, bar-room, or other place. The body of the pump consists of a metallic cylinder of such capacity as may be required, and this is to be furnished with a piston, the rod of which extends downwards through the lower end of the cylinder, and is worked by a lever under a counter, or in any other convenient situation. From a head, or cap, on the upper end of the cylinder descends a number of tubes which are to pass through the floor, and are to be connected respectively to the barrels, or other vessels, from which the liquors are to be raised. In the centre of the cap from which the respective tubes proceed, there is inserted a spigot, or key, which is to be turned like that of a common cock, and which, by the position it is made to occupy, will determine the kind of liquor to be drawn, and will direct its discharge into the vessel which is to receive it.

Claim.—"What I claim as new, is the manner in which I employ a revolving key, or spigot, made tubular at its lower end, and having a slot, or opening, through it, so that said slot may be made to coincide with either of several openings in the socket, within which it revolves; said openings, with the exception of one of them, being connected by a tube with an appropriate reservoir, and, the one above excepted, being connected with a discharge spout; the whole apparatus being constructed, arranged, and operating substantially as herein described."

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3. For an improvement in the *Screw Press, and in the apparatus for separating Elaine from Stearine;* Richard Jones, Circleville, Pickaway county, Ohio, October 9.

This "improvement in the screw press consists in attaching to the shaft of the screw a scroll, or fuzee wheel, to the larger end of which scroll, or fuzee wheel, one end of a rope, or chain, is to be attached, and after being wound around said scroll wheel, or fuzee, the other end of said rope, or chain, may be attached to a windlass, or to a second scroll wheel made to operate as a windlass, or the rope may be passed over a pulley, and be drawn upon by a weight affixed to its end."

Claim.—"What I claim as new, is the combining of the scroll, or fuzee, wheel with the screw, by placing the former on the shaft of the latter, and employing it in the manner, and for the purpose set forth. I do not claim the use of a scroll, or fuzee, wheel, as applied to a press, for the purpose of obtaining a progressive increase of power, this having been before done; but I do claim the direct application thereof to the shaft of a screw, as set forth. I likewise claim the manner in which I use alternate plates of solid and of perforated metal, between the packages of lard, tallow, &c., in the trough, so as to provide spaces between each pair of plates, for the ready escape of the elaine as described."

The principal object of the above press is for the separation of stearine from elaine; and the last section of the claim is to a mode of arranging the tallow, or lard, in the box of the press.

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4. For an improvement in the *Floating Dry Dock;* Daniel Dodge, and Phineas Burgess, New York City, October 9.

This is for an improvement in that kind of docks known under the appellation of the sectional floating dry dock, and consists in connecting the machinery employed in moving the end floats in all the sections together, by means of universal and extension joints, that the distance between the sections may be varied without breaking the connexion of the shafts.

Claim.—"It will be remembered that we have described parts which have long since been used in floating dry docks, and that, therefore, we do not claim them as our invention, but what we do claim, and desire to secure by letters patent, is the method herein described, of moving the end floats in all the sections, with the same degree of velocity, so as to insure an equal strain upon all the parts of the vessel, to be raised by connecting the main shafts on all the sections, on each side, by universal and extension joints, substantially as herein described."

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5. For an improvement in *Mills;* Josiah Platt, Weston, Fairfield county, Connecticut, October 9.

Claim.—"Now I am aware that the upper stone, or runner, of a mill for grinding grain has been operated by a spindle working in boxes above it, and that it has been weighted by attaching weights to the top thereof, and hence I do not claim for these things; but I wish to confine my claim to the peculiar manner in which I have effected these things; that is to say, I claim as my invention and improvement, and desire letters patent for suspending the spindle of the upper stone, or runner, by a sliding frame, in the manner and for the purpose specified. I also claim the suspending the upper stone, or runner, to the lower end of the spindle, by having the bail work in a slit, or cleft, in the spindle, and the two jointed together, and fastened by a pin passing through them, as described; and finally, I claim regulating the weight and friction of the upper stone, or runner, by placing semi-circular weights in a cavity, made therefor, in the upper part of the whirl, or wheel, as described."

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6. For an improvement in the mode of *Causing the Wheels of Locomotive Engines to adhere to the Rails;* Elisha Tolles, New York City, October 9.

Claim.—"What I claim as new, is the manner of constructing and combining the apparatus for the distribution of sand upon the lines of rails on railroads, by the conjoint action of reservoirs of steam and of sand, the sand to be placed in a reservoir from which the steam is allowed to issue through pipes, or tubes, surrounding those through which the sand is made to issue, by an arrangement of parts substantially the same with that set forth. I also claim the combining with the apparatus, for distributing the sand, the scrapers, or ploughs, for cleaning the rails from snow, or other foreign matter, said scrapers being attached to elastic arms of metal, and otherwise formed, arranged, combined, and governed in the manner described.

"It will be manifest that instead of passing a current of steam through the outer tube, or pipe, to cause the sand to be discharged from the inner tube, a strong current of air, either heated, or not, may be forced through the outer tube, and that a like mechanical effect would be thereby produced. Such a blast may be derived from a blowing apparatus of any suitable kind, such as are well known, and often used with locomotives; and I therefore claim the substituting, in the apparatus herein described, a blast of air for the current of steam."

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7. For an improvement in *Lightning Conductors;* William A. Orcutt, Boston, Massachusetts, October 9.

Claim.—"What I claim as my invention, is the method of connecting lightning rods, or conductors, by means of a nut, or hollow cylinder, with the receiving, or discharging, point cast thereon; but I expressly disclaim the invention of connecting rods of metal by a nut, or hollow cylinder."

The ends of the rods to be connected, are screwed into this nut, from which the receiving, or discharging, point projects at right angles to the longitudinal axis of the rods.

8. For an improvement in *Blinds for Horse Bridles;* John G. Tibbets, New York City, October 9.

"The nature of this invention is to construct the bridle with leather arch blinds, nearly encircling the eyes, projecting forward and spreading outward in such a manner as not to chafe, or heat, the eyes, and exclude the air, and torture the animal, and eventually cause him to become partially, or entirely, blind, but to allow the eyes to be entirely free, cool, and open to an unobstructed circulation of the air around them, and to a direct view forward and laterally, of objects in their natural light and form, and at the same time prevent him from seeing what is going on behind, or over, him, and thus prevent him from taking fright from these causes, and suffering the evils complained of; said blinds being susceptible of an addition, or wing, at right angles thereto, for the purpose of preventing the animal seeing to the right, or left; said improvement being applicable to the bridles of carriage, as well as saddle horses."

Claim.—"What I claim as my invention, is the before described mode of constructing bridles arching over the eyes, and flaring, in combination with the flanches, or wings, in the manner and for the purpose set forth."

9. For a *Support for Copy Books in Teaching Writing;* William Davison, Baltimore, Maryland, October 9.

"This copy support is a rectangular piece of tin wired around the edges, to which is attached the copy book wings and clasps by hinges. The book is riveted to a piece of tin hinged to the before described wire, at one end of said support, or back, the corners of the said piece of tin being cut off to permit the book to open freely when it stands supported at the angle required."

Claim.—"What I claim as my invention, is constructing the copy book with hinges, or wings, to support it when opened, as described, and, in combination with said wings, the clasps for retaining the leaves in place when the book is opened and supported."

10. For an improvement in the *Art of Writing,* by a construction of fountain pens, adapted to writing on a guide formed of ground glass, &c.; William Davison, Baltimore, Maryland, October 9.

"The nature of this invention consists in writing upon the surface of ground glass, with a pen of peculiar construction, prepared with fine chalk, so as to render smooth the surface, prevent the spreading of the ink, and give perfect legibility to the writing, arranged and secured in a peculiarly constructed hinged metallic frame, which folds upon a metallic back, or plate, in the manner of the covers of a book, between which frame and back are placed a series of systematic exercises, or copies, under said prepared glass, the pen with which the ink is laid upon the glass being provided with a reservoir attached to the concave part, which takes a supply of ink at each dip. There is a piece of sponge compressed and put in a cup provided with a handle, for the purpose of washing off the writing.

Claim.—"What I claim as my invention, is the combined employment of a guide, as aforesaid, with a fountain pen of the construction described. I do not claim. as my invention, the attaching of a reservoir to metallic pens, for affording a supply of ink, as reservoirs have been applied to the backs of metallic pens; but what I claim as my invention, is combining the reservoir with the concave side of the pen by attaching a separate sheath to the back of the reservoir, or fountain, into which the pen is inserted substantially as set forth, by means of which arrangement the escape of the ink is prevented on the downward stroke of the pen, as by the pressure upon it, the surface of the pen is removed from the fountain, or reservoir, while in the old arrangement the pressure had the effect of opening the nib, and by bringing it nearer the reservoir increasing the flow of ink. I also claim the employment of chalk on the surface of the ground glass, as described, for the purpose of producing a whiteness on the surface, rendering the writing upon the surface more apparent, and preventing the ink from spreading, and rendering the surface more like paper. I likewise claim the method of employing sponge in a condensed form, by combining it, in the manner described, with a holder constructed as set forth. I also claim the combination of the case, roller, and wiper."

This last improvement consists of a roller within a tin case, which partly surrounds the roller, and then has the two edges turned in contrary directions. The cloth constituting the drier is passed over the roller, and put in the case by springing it open.

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11. For an improvement in the manner of *Casting Butt and other Hinges;* Thomas Shepherd, Philadelphia, Penn., October 9.

The hinge pin, or shaft, is provided with flanches, to form the divisions of the knuckles of the hinge, and the spaces which are to receive the turning half of the hinge, are turned in a lathe, and the others left rough, that the cast metal may adhere. The pins thus prepared are put in the mould, and the spaces intended for the reception of the knuckles of the second half are filled up with sand, and after the first half of the hinge has been cast, it is put in the mould to receive the second half.

Claim.—"What I claim as new, is the casting of butt, or other, hinges, by preparing a shaft of cast metal, in the manner set forth, and laying the same in the flask with the spaces filled with sand, which are to form, or receive, the jointed knuckles of the hinge, and casting the first half thereon; and, as a component part of the operation, the subsequently placing this half in the flask, prepared as set forth, for the casting of the second half; the mode of procedure in all respects being substantially the same with that above made known. I do not claim the mere manufacturing of hinges by casting the first half, and placing this in the flask, to have the second half cast upon it, nor do I claim the casting of a hinge upon a joint pin, with washers between their joints; but I do claim the so doing, in combination with a shaft, or joint pin, formed and prepared in the manner made known."

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12. For a machine for *Cutting, or Making, Splints of Wood for making Brooms;* Lyman Gleason, Le Roy, Genesee county, New York, October 9.

Blocks of elastic wood, such as is generally employed for making brooms, are cut, by any known machinery, into pieces of the length of the required splints, and as thick as their intended width. These are presented to the operation of knives attached to a cylinder extending from end to end, and at about an inch from the surface thereof; and between the knives and the cylinder there is a spring clearer, which forces the splint out as soon as it is separated from the block. The thickness of the splint will depend upon the feeding of the block to the knives.

Claim.—"What I claim as new, is the employment of the spring clearer, in combination with the knives, and with the curb, for the purpose, and arranged in the manner substantially as described."

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13. For *Raising Water by an Endless Chain of Buckets,* applicable to other purposes; John Dutton, Aston, Delaware county, Pennsylvania, October 9.

As the chain of buckets for raising water is well known, it is only necessary to say that this patent is granted for a peculiar manner of forming the buckets, so as to discharge the water to better advantage into a shoot which carries it off. The mouth of the bucket is narrowed, and the sides extend up, forming flanches on the back, or that side opposite the one on the chain, to form a conduit for directing the water of the next bucket into the shoot, as it begins to turn over the upper drum, and thus save much of the water lost in the old methods of making the buckets.

Claim.—"The invention claimed consists in the mode of constructing the buckets; that is to say, curving the sides inward at the mouth, to form a beak, in combination with the spouts formed on the back of the buckets and the shoot, as before described."

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14. For an improvement in the *Smut Machine for cleaning Grain;* Lewis Greeve, Tiffin, Seneca county, Ohio, October 9.

Claim.—"What I claim as new, is the mode in which I have combined the stationary and the revolving disks furnished with teeth upon their surfaces, with the revolving arms carrying square, vertical rods of iron, the whole being arranged, combined, and operating as set forth."

The disks are placed above the beaters, and the under and revolving one on the shaft of, and revolving with, the beaters. The grain passes in between the two disks, to be acted upon by the teeth through an eye in the permanent disk, and from these disks it is discharged, and acted upon by the beaters.

15. For an improvement in *Propelling Vessels;* Daniel Fitzgerald, New York City, October 9.

On each side of, and of sufficient diameter to cover, the bow, there is a large disk working on a shaft, for diminishing (as we are informed,) the resistance of the water to the motion of the vessel.—That "there is more in heaven and earth than is dreamed of in our philosophy," we have the authority of the great poet for saying; and this invention satisfies us that we may add, "and in the brain of some inventors." The vessel is to be propelled by a vertical wheel working within a case under the water line, the paddles passing out below this casing at the bottom of the boat, or vessel, and air is to be admitted through tubes extending from the centre of the wheel to above the water line.

Claim.—"What I claim as my invention, is the application of revolving circular disks to the bow of the vessel, for diminishing the resistance in passing through the water, by separating the particles of the fluid, and turning them aside to prevent the bow impinging on them in sailing with great velocity. I likewise claim the introducing of air to the submerged wheel, in the manner and for the purpose set forth."

16. For an improvement in the mode of *Building Vessels, Boats, &c.;* Joseph Francis, New York City, October 11.

This is for an improvement on the mode of building boats, &c., on temporary frames, or moulds, by bending boards in courses crossing each other, and the improvement consists in securing the boards to each other by spikes, or tree nails, passing through the width of one board, and into the edge of another.

Claim.—"What I claim as my improvement on the mode of building boats, vessels, &c., on temporary frames, or moulds, is the method of fastening the planking together edgewise, as described."

17. For a *Submarine Gun Boat;* Daniel Fitzgerald, New York City, October 11.

The patentee says,—"The nature of this invention consists in constructing a gun boat, so that it may be wholly, or in part, submerged at pleasure, having the use of two, or more, large guns; in propelling said gun boat by means of conical, or other shaped propellers, with spiral paddles revolving on and extending over the whole, or part, of the bow, or stern—in the arrangement of a gunwale on the boat having a cut-water—in elevating bow and stern guns by attaching one on each end of a balance lever; and in elevating and depressing a central gun by placing it upon a platform supported on a piston fitting a cylinder into which steam, or compressed air, is admitted for raising it." To this summary should be added two other improvements described and claimed in the patent, viz., the employment of a spiral propeller at the bottom of the boat, with the shaft vertical, for the purpose of forcing the boat under water, or to the surface; and also a mode of affixing explosive shells to the bottom of an enemy's ship, by means of a pointed bar attached to the shell, one end of which is pointed to enter the enemy's ship, the other passing through an aperture in the side of the boat, with a cord attached to the lock of the shell for the purpose of discharging it.

Claim.—"I do not claim as my invention, the mere employment of a screw, or screws, for propelling boats, as this has long since been done, but not in the manner described by me; and, therefore, what I claim as my invention, and desire to secure by letters patent, is the method described, of propelling boats by means of propellers with spiral, or oblique, paddles revolving around and extending over the bow, or stern, or both, in manner substantially as described. Second, I also claim, in combination with the method of propelling described, the employment of a gunwale on the boat, having a cut-water extending over the propeller, substantially in the manner and for the purpose set forth. Third, I claim the method of elevating the bow and stern guns by attaching one on each end of a balance lever, as described. Fourth, I claim the method of elevating and depressing the central guns, by placing them on a platform, or piston, fitted in a cylinder into which steam, or compressed air, is admitted, as described. Fifth, I claim the method of making the propellers with spiral wings extending in contrary directions, one placed at each end of the vessel, for propelling the vessel, and keeping her steady, and in trim. Sixth, I claim the mode of raising and lowering the boat, by means of the spiral conical propeller, placed in a vertical position at the keel, as described. And seventh, I claim the mode of affixing an explosive shell in the side of an enemy's vessel, by means of a pointed rod in combination with the mode of discharging it, by means of a cord connecting the lock, or match, with the gun boat."

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18. For a mode of *Doubling the Motion of a Crank Shaft*, actuated by a reciprocating motion of any kind; Charles Johnson, Amity, Bond county, Illinois, October 11.

Instead of attaching the connecting rod directly to the crank, as is the usual practice, by which one revolution is given by one entire stroke back and forth, it is attached to one arm of a progressive lever, or toggle joint, the other arm being jointed to a slide from which a connecting rod extends to the crank, so that each stroke back and forth of the piston, &c., vibrates the toggle on each side of a vertical line, and thus gives the slide double the number of strokes.

Claim.—"What I claim is the combining of the progressive, or toggle joint, levers, with a reciprocating shaft with a slide, and with the crank of a fly-wheel, for the purpose and in the manner set forth."

19. For improvements in machinery for *making Lead Pipes;* Geo. N. Tatham, and Benjamin Tatham, Jr., Philadelphia, Pennsylvania, October 11.

This is for improvements on a machine patented by Benjamin Tatham, jr., and Henry B. Tatham, as the assignees of Charles and John Hanson, of Great Britain, on the 29th of March, 1841, and noticed in this Journal at page 346 of the third volume, third series, to which the reader is referred for an explanation of the general principles of the process and machinery.

Claim.—"We do not claim, as of our invention, any part of the cylinder, or of the dies, nor of the arrangement thereof in the cylinder, nor the manner of adapting these to the hydraulic press, nor the mode of operation generally; but what we do claim as constituting our invention, and desire to secure by letters patent, are first, the long core, or core holder, formed, and held stationary with relation to the dies, as described. Secondly, we claim the constructing of the piston hollow, in the manner described, and the combination of the same with the long core, or core holder, upon which the piston slides. Thirdly, we claim, as a modification of our invention, the arrangement and combination of the several parts above mentioned, as exhibited in what has been termed the 'reverse arrangement.'"

The two first claims need no farther explanation, and as the other would require drawings, we deem it not to be of sufficient importance to add them.

20. For an improvement in *Ferules for Canes;* Jonathan Ball, Buffalo, New York, October 11.

Claim.—"What I claim as my invention, is the employment of a spiral spring in the ferule of a cane, crutch, or wooden leg, against which the end piece bears, in pressing down the cane, &c., in the manner described."

21. For an improvement in *Valves, to be applied as throttle, or regulating, Valves in Steam Engines;* William Garlin, Providence, Rhode Island, October 11.

The face of the valve and its seat are semi-cylindrical, and the valve has a stem which passes through a mortise in a vibrating rod, so that the valve adjusts itself at all times.

Claim.—"What I claim as my invention, is the manner of connecting the valve with the rod, so as to adjust itself to the seat on which it moves, by the stem passing up, or down, through the slot in the rod, as the case may be, the whole combined as set forth."

To be Continued.

JOURNAL

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FEBRUARY, 1845.

CIVIL ENGINEERING.

Propelling by Steam Power on Canals. By W. Cossage.

My attention has been directed to a paragraph in the *Mining Journal* of the 21st ultimo, relating to the claims of Mr. H. Davies, of Norbury, near Newport, Salop, to the credit of being the first to apply steam power *successfully* to the traction of boats on canals, in which it is stated that "Captain Carpenter, 'long before Mr. Davies had been heard of,' introduced steam traction on the Grand Junction Canal." As I am in a condition to speak exactly to the facts of this case, I trust you will permit me to do so, and thus enable the public to judge as to whom the merit of having practically effected this important application is really due.

In the year 1841, Captain Carpenter applied to the Birmingham Disk Engine Company (of which company I was then acting as director,) to furnish the Admiralty with a disk engine of five horse power, and suitable gearing for driving a set of his patent stern propellers, to be fixed in the pinnace-boat of her majesty's frigate *Geyser*, of which vessel Captain Carpenter was then commander. Mr. Davies, being at that time the superintendent of the Birmingham Disk Engine Manufactory, prepared drawings of such gearing as he thought suitable for connecting the engine with the propellers, and these were approved of by Captain Carpenter. The whole of the work, except the propellers, was subsequently executed by the Birmingham Disk Engine Company agreeably with these drawings, and under the superintendence of Mr. Davies. Up to this time, Captain Carpenter had not applied *any* steam engine to drive his propellers on board a boat. This boat being completed, I was present at numerous trials of her capabilities, in which we found, that, on the river Thames, where the width and depth of water are great, she accomplished a speed of nearly seven miles per hour; also, that she could tow a gun-boat conveying a large number of soldiers, at a speed of about four miles per hour. I also attended an experiment made with this boat on the Grand Junction Canal, in the presence of Sir F. B. Head, and other gentlemen interested in canal navigation, and we found that, working singly, and without cargo, she steamed a distance of about five miles on that canal, at the rate of nearly five miles per hour—and, in returning, she took in tow one loaded boat, and with this accomplished a speed of three and three-quarter miles per hour. Thus, a distance of nearly ten miles was *steamed* by Captain Carpenter's boat on the Grand Junction Canal, during one-half of which the boat was alone and without loading, and during the other half one loaded boat was towed. This is the extent of steam traction performed by Captain Carpenter on the Grand Junction Canal, and it was deemed so promising of further important results, that the directors of this canal company presented Captain Carpenter with a handsome gratuity, in acknowledgement of his exertions on behalf of canal interests. Consequent upon this experiment, the Birmingham Disk Engine Company fitted up a boat for Messrs. Pickford & Co., with a disk engine, and a set of Capt. Carpenter's stern propellers, with a view to this being employed in their carrying trade—all the arrangements adopted being approved by Capt. Carpenter. In the mean time, Mr. Davies became more fully convinced, from the above trial of Capt. Carpenter's boat on the Grand Junction Canal, of the correctness of an opinion he had entertained from the first, and which he had repeatedly expressed to myself and others, that the employment of stern propellers on canals (in which the width and depth of water are comparatively small,) was wrong in principle, and he, therefore, constructed a boat having screw propellers placed on each side of it near the bows. These two boats, viz., the one belonging to Messrs. Pickford & Co., fitted with Capt. Carpenter's propellers, and the one belonging to Mr. Davies, fitted with screw propellers placed according to his views—were each furnished with a disk engine of five horse power, and the result of numerous comparative trials made with these will be collected from the following letter addressed by R. S. Skey, Esq., the general agent of the Birmingham and Liverpool Junction Canal Company, to the *Midland Counties Herald:*—

"*Sir,*—In a recent number of your paper, in a paragraph alluding to the introduction of steam power on the Birmingham and Liverpool Canal, I observe it is stated that I, having been invited to witness the performance of a boat fitted up at the Disk Engine Works, on Captain Carpenter's principle, was so struck with the superiority of the plan, as to recommend its adoption. Now this statement is so calculated to mislead those who, like myself, may be interested in the application of steam power to canal navigation, that I must beg the favor of your allowing me to correct it. Captain Carpenter's plan is to drive the boat by stern propellers of a peculiar form, and all experience has proved that stern propellers, in any shape, cannot be applied with advantage to the tugging of boats on canals. I feared, and Mr. Davies anticipated from the first, it would prove, what for our purpose it certainly was, a complete failure. So strong was Mr. Davies' impression that this would be the case, that he, without waiting for the result of a trial, commenced building for himself a boat to be propelled on a totally different principle. She was fitted with engines of the same power as the boat on Captain Carpenter's principle, and I tried both boats on the Birmingham and Liverpool Canal on the same day, and at the head of the same train. A very short experiment showed so evidently the inefficiency of the one, and the excellence of the other, that we resolved at once to adopt Mr. Davies' principle. Our boats, which were built from his plans, and under his inspection, have nothing in common with the one on Capt. Carpenter's plan, except that disk engines are used in both. We consider these engines to have some considerable advantages for the purpose, but, of course, the kind of engine to be employed is a mere question of cost, space occupied, and fuel consumed. I am anxious the public should know the truth; for much time, talent, and money, have been already sacrificed, as many clever and enterprising men know to their cost, in the attempt to accomplish, by the use of stern paddles, or propellers, that in which Mr. Davies has succeeded by very different means; and I should be sorry if an inaccuracy, which it is in my power to correct, should lead others into similar loss and disappointment. "ROBERT S. SKEY.

"*Canal Office, Audlem, Oct.* 10, 1843."

After the trials above referred to by Mr. Skey, the engine was taken out of Messrs. Pickford's boat, and Mr. Davies was engaged by the Birmingham and Liverpool Junction Canal Company, to carry out his views of steam propelling; and, during the year 1843, he succeeded in accomplishing a complete system of steam traction on their canal, in effecting which Mr. Davies invented and applied a new apparatus for connecting a number of boats together, so as to form a long train, capable of being steered by one man. So complete a change in this mode of conveyance excited great public attention, and some of the local newspapers having attributed to Mr. R. S. Skey, the merit of accomplishing this change, that gentleman immediately addressed a letter to the editor of the *Chester Courant*, published in that paper of the 19th of September, 1843, in which, referring to such report, he says:—"Now, this merit is not mine, and I am anxious to take the earliest opportunity of disclaiming it. The tugs were built, and others are now building, under the superintendence of Mr. Davies, the inventor of the disk engine, who had previously given proof of his fitness for the task, by constructing a boat, against which none of the ordinary objections could be raised. I am happy to give my testimony to his success, which has been so complete, as to induce us to abandon all idea of moving our trains of boats by horse power."

Amongst other parties whose attention was directed to these performances, Mr. Ellis, agent to the Union Canal Company in Scotland, availed himself of an opportunity to investigate the working of this system, and Mr. Davies furnished him with the model of a boat suitable for their canal, and with details of the connecting and steering apparatus he had invented. Two towing boats were constructed according to this model, and Mr. Davies furnished the propellers which were applied to them. The performance of these boats was highly satisfactory, and drew forth commendatory notices in the *Glasgow Citizen*, and other local newspapers; but, as the merit of the arrangement was attributed incorrectly to some gentlemen of that neighborhood, Mr. Ellis, under the signature of "A Correspondent," addressed a letter to the editor of the *Glasgow Citizen*, (copied into the *Mining Journal* of August 31, 1844,) doing justice to Mr. Davies' claims.

Mr. H. Davies has constructed eight towing boats, fitted with disk engines, for the Birmingham and Liverpool Junction Canal Company, and these are now, and have been, for upwards of twelve months, regularly employed in carrying on an extensive traffic on a line of canals extending from Autherley, near Wolverhampton, to Ellesmere Port, on the Mersey, a distance of sixty-nine miles, in which two trains, usually consisting of six, or eight, loaded boats, are started from each terminus of the above line every day, and, by this means, a quantity of merchandize, averaging between two thousand tons, and three thousand tons per week is conveyed by the use of steam power on canals. The average weight of merchandize conveyed in each train exceeds one hundred tons, and the haulage of this for one mile is effected by the consumption of less than one-half cwt. of coal; consequently, the power of hauling one ton of goods one mile is yielded by the consumption of *less than half a pound of coal.* The engine is managed by one man; the train of boats is steered by one man; and the sole additional attendance is that of a conductor, (whose chief duty is to prevent pilferage,) except in passing locks, when extra assistance becomes necessary. An equal quantity of goods could not be moved by horse power, without the continued employment of six horses, with the requisite relays for changing these, and at least twenty-four men on board the boats.

Independently of Mr. Davies' arrangements for applying steam power to this purpose being totally different to those of Captain Carpenter, and others, I feel justified in stating that he is the first person who has applied this power to conveying goods on ordinary canals, to such an extent as can be considered *commercially useful;* for, although numerous attempts have been made to effect this object, yet, as in the instance of Captain Carpenter, these have all been abandoned before they have produced any practical result; therefore, I consider that the merit of being the first to apply this power usefully to canal navigation is due to Mr. Davies, and I feel confident that if the proprietors of this property were to avail themselves of the means thus presented to them, they would soon place their interests in a position very different to that to which the use of this power on railways is rapidly reducing it. I am induced to trouble you with this letter, to do justice to a talented and deserving individual; for, although my pursuits are now very different to those of the period referred to, I cannot but feel interested in a matter to which I then devoted much time and attention, and am, therefore, desirous to contribute the information I possess as to the merits of this case.

Swansea, October 16, 1844. Lond. Min. Journ.

Description of the Roof of the New Houses of Parliament.—From Weale's Quarterly Papers on Engineering.

Of the superiority of iron over wood in the construction of roofs for buildings, the architects of the present day are becoming fully convinced, and the splendid example now set before them by Charles Barry, Esq., should at least induce all who have hitherto been indifferent to the advantages of this material in the essential qualifications of lightness, strength, durability, and safety, in cases of fire, to examine the subject with all the attention it deserves, and the result may be looked for in the more rapid progress of the substitution of iron for wood in constructing the principals of roofs, especially when of large span. Not to the roofs only, but to flooring joists, or girders, the metal material is happily adaptable also, wherever resistance to fire, and great strength, with small section, are primary objects in their construction. Of these valuable properties, the architect of this edifice has wisely and very fully availed himself, and he has, moreover, been, by this selection, enabled to offer facilities for carrying into complete effect the most complicated details of construction in flues, &c., required for the proposed system of ventilation for the extensive pile of building under his care.

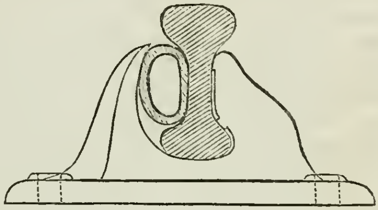
But beyond the use of iron in forming the principals of his roofs, Mr. Barry has ventured to a further step, of which those unacquainted with the experience that he is cognizant of might not fully understand the wisdom, but which is thoroughly approved by all practical and scientific persons who have examined the subject minutely. We refer to the coverings of the roofs with cast-iron plates of a thin section, and galvanized by a process now admitted to present the best yet discovered means of protecting iron work exposed to the air and weather from their otherwise injurious effects.

Upon the many substantial advantages thus attained, we are induced to state briefly the impressions we have received from an attentive examination, we might say, most interesting study, of the roofs delineated and detailed in the eight accompanying plates. The cast-iron plates being cast of sufficient size to span the distance between each adjoining pair of principals, dispense with the necessity for any kind of boarding whatever, thus saving not only a great expense, but also diminishing the chances of damage by fire, which would, by destroying this boarding, leave the slates without sufficient support, thus making the whole roof liable to be broken in by their derangement; or, in the case of lead covering, the fire from the boarding communicated to the lead, would speedily reduce it to a liquid state, and create the most disastrous, or fatal, consequences. Again the cast-iron plates allow the formation of ornamental rolls on the exterior, and parallel with the rafters, at the same time having vertical joints beneath these rolls, which, together with the horizontal joints, are so contrived as to be perfectly impervious to the admission of water. The architect being thus enabled to communicate an architectural character to the very roof, which cannot fail to be highly esteemed when seen in connexion with the striking features of the masonry below, when the edifice is completed. And these rolls, it must be remembered, which, in slate covering, would be impracticable, and in lead liable to considerable distortion and injury, are, when formed in iron, and cast as parts of the plates themselves, not liable to injury by any ordinary means, or circumstances, and will always retain their form, position, and imperviousness to wet and weather. To whatever purpose the spaces, or rooms, within the roofs may be applied,—and these spaces must, from the high pitch of the roofs, be very valuable for many purposes,—it is evident that uniformity of temperature will be highly desirable; and this will be attained, it is believed, to a much greater degree by an iron covering than by one of lead, slate, or any other material. The corners of each plate being firmly secured by screws and snugs to the rafters on which they lie, a greater degree of lateral strength and stiffness is attained than can be had with any other kind of covering; in fact, the whole roof, principals, and covering become one piece of framework, well knit and secured together at all points by metal connexions, so that the longitudinal tie-rods, which are introduced at the intermediate points, are very much lighter than would otherwise have been advisable, and yet are abundantly sufficient for their purpose. Much greater facilities are likewise offered by this description of covering for the attachment of ornamental dormer windows, which the architect has introduced for the purpose of lighting the rooms within the roofs, and which could not, in any other material, have been so neatly, durably, or safely, constructed and attached to the covering. In point of durability merely, if lead be allowed a comparison with iron thus prepared and adopted, the latter must be pronounced the better material. As to weight, little or no difference can be stated; and regarding their comparative expense, it is believed, allowing fairly for all circumstances, the preference must be awarded to iron. Slate, of course, cannot sustain a comparison of durability, has little advantage in lightness, and not much in point of expense. But the many valuable peculiarities belonging to iron for the purposes required, and at some of which peculiarities we have above glanced, should be held thoroughly decisive as to its employment in the erection of an edifice of which not only the architect in the present age, but the nation for many centuries, should be justified in feeling proud.

Civ. Eng. and Arch. Journ.

Railway Keys. *By* W. H. Barlow.

The drawing of my hollow iron keys, which is given in your last number, is calculated to produce an erroneous impression as to one of the great advantages which they possess over modern keys. In your drawing you have shown the key as only fitting into the upper fin of the rail. In the enclosed sketch you will perceive that they fit into both the upper and lower fins, and this gives them a great advantage as joint keys, for the key being elastic the driving causes the contact with the rail to be very perfect, and the metal being hard no unevenness of the joint, or *canting* of the joint chair can take place, which is one of the great evils felt with wooden keys, for here the wood being comparatively soft and soon affected by abrasion, also the hold of the key on the rail being subject to great variation and shrinking of the wood in wet and dry weather, the joint chairs become canted, and the two ends of the rails out of level, which not only interferes with the comfort of traveling from the noise made in passing the joints, but produces unnecessary wear and tear in the engines and carriages, and increases the labor of repairing the road.



About two miles of the Midland Railway, that is four miles of single line, in the neighborhood of Rugby, which has been laid with these keys, show a remarkable difference in the steadiness of the road, and the quietness of the joints, as compared with the wood keys. It has been laid about six months, and the keys maintain their position, and hold on the rail as firmly as the first day they were put in.

The hollow iron keys require rather more care and accuracy in laying the road than the wooden keys, but in other respects they are quite as easy to use, and drive readily into their places with the common keying hammer; however, I must not say too much in favor of my own invention; several engineers are now making trial of these keys, and we shall probably in a few months learn their opinion of them.

Ibid.

Resistance of Railway Trains.

Mr. Scott Russell detailed a number of experiments on the Sheffield and Manchester Railway. For the purpose of these experiments it was necessary that the railway should present long and very steep gradients. The experiments were as follows:—1. Trains of carriages, empty, were put in motion at the summit of an inclined plane, at about 30 miles an hour, and were allowed to descend freely. 2. Trains of carriages, loaded, were tried in the same way. 3. The engine and tender were treated in the same way, being put to a velocity of between 30 and 40 miles per hour, and allowed to descend freely the whole length of the inclined plane without any train attached. 4. The engine and tender, with a train attached, were propelled to the top of the inclined plane, and then allowed to descend freely by gravity; by these means the following results were obtained:—1. The resistance to railway carriages at slow velocities does not exceed 8 pounds per ton. 2. The resistance to a light railway train of six carriages, at 23.6 miles an hour, was 19 pounds per ton. 3. The resistance to a loaded train of six carriages, at 30 miles an hour, was 19 pounds per ton. 4. The resistance to a light train of six carriages, at 28 miles an hour, was 22 pounds per ton. 5. The resistance to a loaded train of six carriages at 36 miles an hour, was 22 pounds per ton. 6. The resistance to a six-wheeled engine and tender, at 23.6 miles an hour, was 19 pounds per ton. 7. The resistance to a six-wheeled engine and tender, at 28.3 miles an hour, was 22 pounds per ton. 8. The resistance to a train composed of six light carriages, with engine and tender, at 32 miles an hour, was 22 pounds per ton. 9. The resistance to a train composed of nine loaded carriages, with engine and tender, at 36 miles an hour, was 22 pounds. Mr. Russell observed, that the subject was of considerable importance, inasmuch as the system adopted for laying down the gradients of new lines was of necessity regulated chiefly by the opinion of the engineer on the question of resistance. How much mechanical force is required to move a given weight of train, along a given gradient, at a given speed, was a question of which the solution was essential to sound engineering, but the profession had long felt that they were not in possession of sufficient data to determine this question.—*Proc. Brit. Association.*

Lond. Athenæum.

AMERICAN PATENTS.

List of American Patents which issued in June, 1844, *with Remarks and Exemplifications. By* Charles M. Keller, *Examiner of Patents.*

1. For improvements in the *Smut Machine, for Cleaning Grain;* Elisha W. Young, of Parkman, Ohio, and Thomas H. Wilson, of Harrisburg, Pennsylvania, June 5.

The rubbing of the grain is effected in this machine, as in many others before it, by two horizontal disks, the under one attached to a shaft, and termed the runner, has its upper face armed with concentric rings of vertical pins, and the other, called the cover, has a series of rings (corresponding in number with the rings of pins on the runner,) which project from its face and have their inner sides ribbed, and a little inclined; the middle ring of the series projects downwards more than either of the others, and serves to arrest the grain more certainly. The spaces between the rings are filled with studs, or points. The grain is fed in through an eye in the centre of the cover, and is carried by centrifugal force beyond the periphery of the runner, and descends between it and the surrounding curb, where it is met, and acted upon, by a current of air from a fan attached to the under face of the runner; thence it runs down inclined planes, which are perforated for the admission of air to the fan on the runner, and then into inclined spouts where it is acted upon by a current of air from another fan at the lower end of the shaft. The lower gudgeon of the shaft runs in a box, or step, the bottom of which is convex, and its centre is kept on the apex of this convex surface by a metal plate which fits the box, and which is provided with a hole for the gudgeon to pass through.

Claim.—"What we claim as our invention, is the cover having a series of concentric rings projecting therefrom, with studs between them, in the manner and for the purpose set forth. We also claim, in combination therewith, the runner constructed and arranged as described. We claim also the inclined planes having their lower sides punched with holes for admitting the air to the (upper) fan, in combination with the runner, as herein specified; and in combination with the spouts for directing the blast from the lower fan, and conducting off the grain, and separating the cheat, &c. therefrom. Lastly, we claim the step constructed as described."

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2. For an improvement in the *Spring Bolt for Doors;* Albert Bingham, Boston, Massachusetts, June 5.

This spring bolt, or mortise latch, can be thrown back, or opened, by either turning the knobs, or pushing them back. The spindle of the knobs passes through a bridle, or loop, on the inner end of the bolt, and through an elongated hole, or slot, in the escutcheon plates, which are also provided with projections, or studs, ranged back of the centre, and one above the other in a vertical line; and the inner faces of the knob sockets, which are concave, have a rib, or ledge, forward of their centre, and ranging vertically. When the knobs are turned, the upper, or lower, end of these ribs, or ledges, strike against the corresponding projections, or studs, on the escutcheon plates, and cause the knobs and the spindle to slide back in the elongated holes, or slots, of the escutcheon plates, and with them carry the bolt back; or the bolt can be retracted by simply pushing back the knobs.

Claim.—"I claim the ledge, or rib, (applied and affixed to the socket, or shank, of the knobs,) in combination with one or two studs, (inserted in, and projecting from, the door, or from an escutcheon plate, affixed to the door,) and an opening, slot, or passage, cut, or formed, through the door and escutcheon plate, for the shank of the knobs to move through horizontally; the whole being constructed, arranged, and operating substantially as described, and for the purpose of retracting the spring bolt either by turning, or sliding, the knob, or knobs, in the manner set forth."

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3. For an improvement in the *Cooking Stove;* Isaac Straub, Cincinnati, Ohio, June 5.

This is for a modification of that kind of cooking stoves in which the fire chamber is placed above the oven, and consists in so arranging the flue spaces, that the draught can pass either directly out, or down the back, under, up the front, and over the top of the oven, and between it and the bottom of the fire chamber. In the back flue spaces there are two partitions, dividing that part of it which extends from the top plate of the stove to the top plate of the oven into three compartments, the two side ones being extensions of the back flue space, and the middle one the exit pipe from the flue between the oven and fire chamber, the latter being provided with a damper to permit the draught to pass directly out, or to carry it entirely around the oven.

Claim.—"What I claim is the manner of forming the space leading to the exit pipe, by means of the partition plates, for the purpose set forth, in combination with the enlarged flue space leading thereto;" (from the upper flue of the oven,) "by which arrangement, and that of the flues leading thereto, I secure an unobstructed draught into the exit pipe; and am enabled to direct the draught around the oven, in the manner herein fully made known."

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4. For an improvement in the *Cooking Stove;* Thomas Bent, Cincinnati, Ohio: assigned to W. and R. P. Resor, of the same place, June 5.

In this stove there are two ovens, one occupying the space between the back of the fire chamber and the back of the stove, and the other the entire space below these. In other double oven stoves the draught passes between the two ovens, but in this it does not, this space being converted into a heated air chamber by a close partition at the back, so that the bottom of the upper, and the top of the under, ovens are heated by the hot air between them.

Claim.—"What I claim is the manner in which the flue spaces are arranged and governed, so as to convert that part which is usually employed as a flue space between the two, into a heated air space, by means of the permanent partition; the whole arrangement of the flues, and their combination with the other parts, being such as described."

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5. For improvements in the *Process of Tanning Leather;* John Cox, of Edinburgh, Great Britain, June 5.

This is for improvements in the method long known of applying the tanning liquor to the hides, or skins, by infiltration, or percolation, and consists in applying the liquor to the skins formed into bags suspended to supply pipes from a reservoir above, and the hides separated from each other by being contained in separate compartments, or stalls, or immersed in a vat of tanning.

Claim.—"I would have it understood that I do not claim the principle of tanning hides, or skins, by causing percolation of liquor by hydrostatic pressure through their pores and fibres, nor the sewing of hides and skins into bags, nor simply filling them with liquor when unconnected with a feeding cistern, and without causing additional hydrostatic pressure; but I do claim the peculiar methods of tanning by hydrostatic pressure, as described. First, I claim tanning hides and skins by hydrostatic pressure, when formed into bags, when they are confined, or supported, or suspended, into continuous smooth sided narrow compartments, or stalls, as described. Secondly, I claim tanning by hydrostatic pressure when a hide, or skin, is formed into a bag, and immersed totally, or partially, into liquor, and either confined in a continuous smooth sided compartment, or allowed to expand, or swell, to its natural dimensions without confinement, or jammed against other hides and skins, as described."

6. For an improvement in *Cork Sole Boots;* William S. McCauley, Baltimore, Maryland, June 5.

Claim.—"What I claim as my invention, is the construction of the cork sole boot in the manner described, having a vand extending from the ball of the foot, where the welt terminates round the toe, which, together with the two in-soles, completely envelopes, and securely confines the cork sole, and they together form a firm basis to peg the out-sole to; the whole being constructed and arranged in the manner and for the purpose substantially as set forth."

7. For an improvement in the *Butter Churn;* Jason B. Schermerhorn, Deerfield, Oneida county, New York, June 5.

Claim.—"I do not claim the general plan and principle of constructing churns with plungers worked either by hand, or by crank, motion, but what I do claim as my invention, and desire to secure by letters patent, is the mode of constructing dairy churns with two rake-formed plungers, with the teeth inter-raking, and with oppositely reciprocating motions, communicated to them by a cranked shaft, as set forth."

8. For an improvement in the *Smut Machine for Cleaning Grain;* James W. Webster, Luray, Page county, Virginia, June 5.

A cylinder with oblique curved beaters works in a horizontal casing, and on the same shaft there is a fan, formed with oblique wings, to force a current of air through the meshes of a reticulated partition in the case, and between the fan and beaters the inclination of the former being the reverse of the latter, so that the current of air shall move in the reverse direction of the grain, and separate and carry off the impurities.

Claim —"What I claim as my invention, is the combination of the cylinder of oblique curved beaters, the oblique wings, and reticulated partition, under an arrangement as aforesaid, for the purpose of cleaning grain as set forth."

9. For an improvement in the method of *Turning Wood Tapering;* Wyllys Avery, Salisbury, New York, June 5.

We have here a modification of that mode of turning in which the wood to be turned is passed through a hollow mandrel, to which are attached the cutters. In this machine the cutter, which gives the taper to the wood, slides in an aperture in the mandrel, and is caused to approach to, or recede from, the centre by a wedge attached to a plate, or collar, that slides on the mandrel; the said plate being embraced by a groove in an arm of a rock shaft, the end of another arm on the same shaft being caused to rise and fall by an inclined guide on the carriage that feeds the machine.

Claim.—"What I claim is the mode of moving the cutter, causing it to recede from the centre of the hollow mandrel, to cut pieces of wood tapering, by the combination of the wedge, plate, arms, and rock shaft, carriage and gauge rod, arranged and operated in the manner and for the purpose set forth, or in any other mode substantially the same, by which analogous results are produced."

10. For a machine for making *Mercurial Ointment;* James W. W. Gordon, Baltimore, Maryland, June 5.

The material to be acted upon is placed in a vertical cylinder, in which works a series of knives that radiate from a hub attached to the lower end of a rod connected by a swivel joint to a sliding cross-head which receives its movement from a crank shaft. One side of the radial knives is flat and vertical, and the other has a double bevel, which bevel causes the whole to rotate as it moves up and down. Other knives may be attached to the radial ones, and so arranged as to project from each side, and at right angles to them.

Claim.—"What I claim as new, is the manner of forming and arranging my combined knives, each of them having a flat and a double beveled side, and being attached, in the manner set forth, to a piston rod, which is allowed to rotate; said combined knives operating in a cylinder in the manner and for the purpose set forth."

11. For an improvement in the *Thrashing Machine for Separating Grain from Straw;* Frederick A. Stuart, Catharine, Chemung county, New York, June 5.

Claim.—"What I claim is the described mode of separating grain from straw by subjecting it to the action of an inclined revolving cylinder of teeth within a smooth case made larger at one end than at the other, for the purpose of allowing the straw and grain to have a spiral movement downwards, and around the cylinder from the feeding board, the discharging end by which it is subjected to the action of the revolving teeth at every revolution of the cylinder, without the danger of the machine clogging, and without the use of any concave of the ordinary construction provided with teeth, said concave being constructed and arranged as before described."

12. For a machine for *Mixing Cements;* William H. Smith, Georgetown, District of Columbia, June 10.

This machine consists of a cylinder closed at both ends, except an opening at one end for feeding in the materials to be acted upon, and another at the opposite end for discharging the cement mixed; within this cylinder there is a rotating shaft with rubbers that extend from the shaft to the inner surface of the cylinder, against which they rub.

Claim.—"What I claim is the above described machine, consisting of a metallic cylinder, metallic axle, and metallic rubbers, all as above described. The cylinder to be either stationary, or revolving, the axle to revolve within it, and the rubbers to be spirally arranged, so as to rub against the cylinder when the machine is in motion."

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13. For an improvement in the *Brick Press;* Mark Twitchell, Gray, Cumberland county, Maine, June 10.

Just under the hopper, which supplies the clay, there is a pulverizer in an inclined position, which consists of two parts, an upper and a lower, with their surfaces armed with teeth, in the form of saw teeth, and set so close together as to sift the clay as well as pulverize it by a reciprocate movement of the under one. The clay is discharged into a box which conducts it to the mould that moves back and forth with a carriage, by means of cams. The mould embraces the bed and piston, the latter sliding within it, and operated by a toggle, or elbow joint, one arm of which is in the form of a bent lever, with one of its arms connected with a crank by a connecting rod, (the other arm is termed in the claim the elbow.) The upper face of the mould has vent holes in it for the purpose of forcing back into the box the surplus clay; the bricks, after being pressed, are forced out of the mould by a small piston that moves at right angles with the main piston.

Claim.—"I claim the construction of the pulverizer, as set forth, the arrangement of the vent, to let off the surplus clay into the box, or hopper, facing the pistons with felt, gum elastic, or leather, and the combination of the small press for discharging the brick with the brick press, said small press being constructed and arranged as described. I also claim the mode of operating the press by means of the elbow and lever, operated by a connecting rod and crank, in combination with the several cams upon the wheel; said cams acting in unison with the lever and carriage—the whole being constructed and operating as set forth."

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14. For an improvement in the *Furnace for Heating Buildings;* George Walker, New Haven, Connecticut, June 10.

Above the combustion chamber there is a drum, the lower part of which is in the form of the frustrum of an inverted cone, and the upper part a semi-spheroid, and at the junction of the upper and lower parts, inside, there is a disk which acts as a deflector, there being sufficient space around it for the passage of the smoke, and other products of combustion. Back of the combustion chamber and of this drum, there are two tiers of such drums, connected together by a pipe at the bottom, and all the tiers are connected together at top by means of a pipe, provided with a damper between the first and second tiers of drums, so that the draught shall pass from the first drum through the top pipe, down the first tier of drums, through the bottom pipe, up the second tier of drums, and through the top pipe into the chimney; the whole is to be surrounded by a hot air chamber of masonry.

Claim.—"I do not claim the parts of the above apparatus, but what I do claim as my invention, and desire to secure by letters patent, is the arrangement of the drums and combustion chamber, in the manner and for the purpose specified."

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15. For an improvement in the *Cooking Stove;* James White, Milton, Northumberland county, Pennsylvania, June 10.

This is for an improvement on that kind of cooking stoves which have two ovens, one back of the fire chamber, and the other under the fire chamber and top oven, and consists of a shield plate, back of the plate which separates the fire chamber and back oven, to protect the articles in the oven from being over heated; this shield plate is attached to, and projects from, a grate parallel with, and a few inches above, the bottom plate of this oven.

Claim.—"I wish it to be understood that I do not claim the diving flue, or double oven; but what I claim as my invention, and desire to secure by letters patent, is the shield plate attached to the grate in the manner and for the purpose set forth, so that it can be removed therewith at pleasure."

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16. For an improvement in the *Water-Wheel;* Daniel Weaver, McKeansburg, Schuylkill county, Pennsylvania, June 10.

The wheel, which is horizontal, and provided with radial buckets, parallel with the shaft, for about two-thirds their length, from the bottom up, and then inclined at an angle of about fifty degrees, is surrounded with tangent shutes, equal in number to the number of buckets, so as to discharge the water on every bucket of the wheel at once. These shutes discharge the water only on the inclined part of the buckets.

Claim.—"What I claim as my invention, is the combination of the wheel constructed as aforesaid, with the circle of shutes in the case in which the wheel is placed, as set forth."

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17. For improvements in the *Cooking Stove:* Calvin Fulton, Rochester, Monroe county, New York, June 10.

In this stove there are three plates between the fire chamber and oven; they are designated in the claim by the letters *a*, *b*, and *c; a*, being the fire back; *c*, the oven plate; and *b*, the one between the two, thus forming two spaces; the one between *b* and *c*, communicates with the flue space around the oven at the bottom only, no current of air being admitted to it; and the one between *a* and *b*, is opened for the circulation of air at the bottom and sides, to prevent the fire back from being over heated. The plate *a*, constitutes only the vertical part of the fire back, and at bottom it is connected with a curved plate *d*, which forms the lower and curved part of the fire back, the two being connected together by catches projecting from plate *d*, that fit into holes in plate *a*, which lessens the tendency to warp. The hearth extends around the ends of the fire chamber, and has ledges projecting out to sustain the oven doors when opened.

Claim.—"What I claim as new, is the employment of three plates between the fire chamber and the oven; the foremost of these plates being divided into two parts *a* and *d*, these parts being connected together, and combined with the plates *b* and *c*, and with the body of the stove, as set forth. I claim also the manner of supporting the drop doors of the oven, by extending the lap, or hearth, back to them, as described."

18. For an improvement in *Couplings for Carriages;* George W. Hatch, Parkman, Geauga county, Ohio, June 13.

The patentee says,—"The nature of my invention consists in providing the forward axle-tree of a wagon, or carriage, with a coupling which will allow the forward axle-tree an easy horizontal and vertical motion."

The horizontal wheel attached to the forward part of the carriage body rests on the axle-tree, which is provided with a curved plate, so that the axle-tree shall have room to vibrate vertically within a limited range, governed by the curvature given to the plate. At right angles to the curved plate, and attached to the axle-tree, there is another plate, the ends of which embrace the rim of the horizontal wheel to assist the king bolt in forming the connexion between the wheel and axle-tree. The head of the king bolt is round, and is received in a countersink in a cross-bar of the wheel.

Claim.—"What I claim as my invention, is the combination of the circular plate with the curved lower plate, the former being embraced by the hooks projecting from the latter; and in combination with these, I also claim the globe head of the king bolt fitting in the concave of the cross-bar, for the purpose and in the manner described."

19. For an improvement in the *Cooking Stove;* John C. Hermance, Schenectady, New York, June 13.

This is for an improvement in the mode of heating the space between the bottom plate of the upper, and the top plate of the lower, oven, such spaces having long since been used in cooking stoves, but not arranged as this is, with the view of carrying through it a current of heated air; this is effected by connecting the space between the ovens on one side, with a space between the top oven and the fire chamber, which receives air from the room, and in which it is highly heated, and on the other side with the diving flue at the back of the stove, which causes the current of heated air to pass through the space between the two ovens.

Claim.—"What I claim as new, is the manner of arranging the heated air space between the upper and lower ovens, causing a current of highly heated air to pass through it by making perforations through the back oven plate in the manner set forth. I do not claim the use of a heated air chamber, or either of the other devices herein named; but I limit my claim to the use of a heated air chamber, under the combination and arrangement thereof described."

20. For *Self-Setting Head and Tail Blocks of Saw-Mill Carriages;* Joseph J. Parker, Plymouth, Washington county, Ohio, June 13.

We are under the necessity of omitting the claims in this instance, because they refer to, and are wholly dependent upon, the drawings. The improvements consist of an arrangement of inclined planes and slides, by which the log is lifted, and the slides moved, so that the weight of the log shall effect the setting, the slides being moved whilst the log is lifted up. By this arrangement the log is lifted up vertically by the motion of the carriage, and its weight transferred on to the slides, instead of pushing the log with its whole weight laterally.

21. For an improvement in *Door Locks;* Linus Yale, Springfield, Hampden county, Mass., June 13.

We have here a rotating permutation lock; the key turns a plate, called a "tumbler" in the specification, which turns within a ring, and there are corresponding radial apertures in the tumbler and ring into which fit pins, or "pistons," that are caused to assume their proper positions, to admit of the turning of the tumbler, by the introduction of the key. On the lower face of this rotating tumbler there is a pin that works in a groove in the bolt, and at right angles with its length, to throw it in, or out.

Claim.—"What I claim as my invention, is the method of throwing the bolt, by means of the pin, on the rotary tumbler working in a groove in the bolt, in combination with the arrangement of pistons in the rotary tumbler and circular rim, as described."

22. For an improvement in the *Cotton Press;* William Sewell, jr., Macon, Bibb county, Georgia, June 15.

This is for a modification of that kind of press in which pressure is made by means of two toggle-joints, arranged one on each side of, and under, the follower, the toggles being drawn together by means of cords, or chains, attached to the joints, and carried around a windlass, or windlasses, located between them. In the press under consideration, the upper arms are longer than the lower ones, and the windlass, or windlasses, are so located in height as to be considerably above the level of the joints when the follower is down, and on a level with them, or nearly so, when it is up; by which arrangement, "at the commencement of the operation the strain of the pressure is borne by the ropes, but as the arms are brought more nearly into a vertical position, the strain is gradually shifted, as the power of the arms increase, from the ropes to the arms."

Claim.—"I am aware that double toggle-joint presses have been constructed with a windlass stationed in the centre, between the said joints, and that pulleys have been used to draw together toggle-joints, in which the ropes extended straight across from the centre joint of one, to the centre joint of the other toggle-joints; and that they have also been made with arms of unequal length; therefore, I do not claim either of these general principles; but what I do claim as my invention, is the combination and arrangement of the toggle-joints, as herein described, with the purchase fixed between said joints, in the manner and for the purpose set forth, so that the lower arms are allowed to fall into a horizontal position, and are raised by a purchase placed at a stationary point, and between them."

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23. For a mode of *Tanning Leather by means of a Flagellator;* Robert Downey, New Albany, Floyd county, Indiana, June 15.

The patentee says,—"The nature of my invention consists in flagellating, or whipping, the hides on the flesh side during and while in the first stages of being tanned. After ten, or fifteen, days, the hides may occasionally be flagellated on the grained side a little. Believing that one of the effects of the bark in the ordinary mode of tanning is to close the pores of the hide, and thus prevent that complete saturation with the bark liquor, which contains the tannin, and on which the perfection of the leather depends, in order to obviate this objection I propose the above named machine, which strikes about twenty-five hundred strokes a minute, and which raises and thickens the hide, and so opens the pores, that at the same time the gelatin and gluten are oozing out, the bark liquor is driven in with the machine, and the hide is made ready for the reception of another saturation, and may be placed either in the revolving, or stationary, handler, until again saturated, which may be known by the closing of the pores, and then the same operation is repeated."

The machine for this purpose, described in the patent, consists of a bed, or carriage, on which the hides are placed, and submitted to the action of a series of rods, or whips, working on a rod near one end, lifted by a series of tappets on a roller, and forced down by springs.

Claim.—"What I claim as my invention, is the flagellating, or whipping, the hides by means of the beaters, as herein described, or any other mode substantially the same."

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24. For improvements in the manner of preparing *Fabrics of Caoutchouc, or India Rubber;* Charles Goodyear, New York City, June 15.

The patentee says,—"My principal improvement consists in the combining of sulphur and white lead with india rubber, and in the submitting of the compound, thus formed, to the action of heat, at a regulated temperature; by which combination and exposure to heat it will be so far altered in its qualities as not to become softened by exposure to the solar rays, or of artificial heat, at a temperature below that to which it was submitted in its preparation, say to a heat of 270" of Fahrenheit's scale; nor will it be injuriously affected by exposure to cold; it will also resist the action of the expressed oils, and that, likewise, of spirits of turpentine, and of the other essential oils, at common temperatures, which oils are its usual solvents."

The compound may be formed of various proportions of the ingredients, but that which is deemed best consists of twenty-five parts of india rubber, five of sulphur, and seven of white lead—the india rubber having been previously dissolved in some of the essential oils, and the sulphur and white lead ground in the manner of preparing paint.

Claim.—"I do hereby declare that I do not claim the combining of sulphur with caoutchouc either in the proportions named, or in any other, this combination having been the subject of a patent granted to me on the 24th day of February, 1839; but I do claim the combining of the said gum with sulphur, and with white lead, so as to form a triple compound, either in the proportions herein named, or in any other, within such limits as will produce a like result. And I will here remark, that although I have obtained the best result from the carbonate of lead, other salts of lead, or the oxides of that metal, may be substituted therefor, and will produce a good effect; I, therefore, under this head, claim the employment of either of the oxides, or salts of lead, in the place of the white lead, in the above named compound. I also claim the formation of a fabric of the india rubber by interposing layers of cotton batting between those of the gum, in the manner and for the purpose described. I likewise claim, in combination with the foregoing, the process of exposing the india rubber fabric to the action of a high degree of heat, such as is herein specified, by means of which my compound is effectually changed in its properties, so as to protect it from decomposition, or deterioration, by the action of those agents which have heretofore been found to produce that effect upon india rubber goods."

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25. For an improvement in *Horse Hames;* Nathan Post, Madrid St. Lawrence county, New York, June 15.

There are two curved levers attached to the front of the hames, and connected together, under the horse's neck, by means of a chain and snap hook. The draught hooks are attached to the hames, and pass around the levers, which, being extended some distance forward of the hames, and connected together, prevent them from twisting, or bending, under the pull of the horse.

Claim.—"What I claim is the combination of the hook and levers with the hames, substantially in the manner described."

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26. For a method of *Hardening and Coloring Wood, &c.;* Charles F. Spicker, New York, June 24.

Claim.—"What I claim as my invention, is the method of hardening and coloring wood by diffusing tannin, or tannic acid, together with vegetable colors, throughout the whole structure of the wood, and incorporating the same therewith, by the aid of caustic potassa, or soda, or other analogous substance, in the mode described, and in varying the color afterwards by the use of metallic salts, whose base has an affinity for tannin, or tannic acid, and also for the application of the same process to manilla grass, and other articles used for cordage and ship rigging."

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27. For improvements in *Air-Heating Furnaces;* Jephtha Bradley, St. Albans, Franklin county, Vermont, June 24.

The grates at the bottom of the fire chamber, on which the fuel rests, are tubular, and communicate at the back with a chamber at the back of the fire chamber, the upper part of which extends over this air chamber in the form of a flue communicating with a long, flat flue above the fire chamber, divided horizontally, by a partition, from the back to within a short distance of the front, leaving space for the draught to pass to the upper division, and from thence out at the pipe, or chimney. This double return flue is surrounded by an air chamber; and, in addition to these, there are other air chambers at the sides of the fire chamber, and the whole is surrounded by a double casing. The side and back air chambers, and, consequently, the whole of the grate bars communicate with the upper air chamber that surrounds the double return flues. In the claim the side air chambers are designated by the letter *i*, the back chamber by the letter *d*, the upper one by the letter *k*, and the double return flue, which it surrounds, by the letter *f*.

Claim.—"What I claim as my invention, is the combination of the air chambers *i*, *i*, and *d*, *k*, surrounding the fire, with the tube grate, the chamber *k*, having a double return flue *f*, therein, as described."

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28. For an improvement in the *Press;* Amos Jackson, New Liberty, Adams county, Illinois, June 24.

The bed of this press is a long lever, nearly horizontal, one end of which is jointed to an inclined piece of timber, at an angle of about 45°; and the follower of the press is another lever above the first, and connected with it at one end by a sword jointed to the lower lever, or bed, and passed through a mortise in the end of the upper lever, or follower, where the two are connected by a pin, which fits into holes in the sword, in the usual manner of forming such adjustable connexions; the other end of this upper lever is mortised, and embraces the inclined piece of timber. The bottom lever, or bed, is lifted up by a windlass and cords, and when liberated makes pressure by its gravity, and that of the upper lever. The articles to be pressed are placed between these two levers, and when their linked ends descend, that end of the upper one, which embraces the inclined timber, is made to approach the lower one, in consequence of the inclination of the timber.

Claim.—"What I claim as my invention, is the combination of the inclined plane with the levers, arranged and operated in the manner set forth, for the purpose specified."

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29. For an improvement in *Bee Hives;* James A. Cutting, Haverhill, Grafton county, New Hampshire, June 24.

Within the bee house there are three drawers, two at the bottom, side by side, and one above them which extends over the two lower ones. The drawers communicate together by numerous small holes, which may be closed, or opened, by slides, having corresponding holes. The drawers are provided with tubes, for the admission of the bees, and those in the lower drawers are located at the junction of the two drawers, to give an entrance to the two drawers by the same tube, which is, however, divided by the partition between the two drawers. There are two of these tubes, one at the bottom, and the other about the middle of the height of the drawers.

Claim.—"What I claim is the employment of separate, or double, slides between the drawers, one for each, constructed and arranged in the manner and for the purpose set forth. I also claim the divided tubes, in combination with the drawers, constructed and arranged substantially in the manner and for the purpose set forth."

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30. For an improvement in *Tanning Leather;* Adam Kettering, and Augustus Vogle, Hempfield, Westmoreland county, Pennsylvania, June 24.

The vats are divided into five sections, each section being divided again into two compartments, one for holding the tan bark, and the other for the hides, the partition between the two being pierced with holes for the passage of the liquor; water is pumped on to the bark in the first vat, which, after receiving a certain degree of tannin, and acting on the leather, is pumped on to the bark in vat number two, where it receives additional strength, and so on throughout the series, the leather being also shifted from vat to vat through the series, as the process of tanning progresses.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the above described process of tanning hides into leather in a quicker manner than usual, and without the aid of steam, or any chemical composition, and, in connexion therewith, the peculiar arrangement of the vats used for said purpose, also as set forth."

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31. For an improvement in the *Cooking Stove;* Henry W. Camp, Owego, Tioga county, New York, June 24.

In this stove, as in many others before it, there are two ovens, one back, and on a level with the fire chamber, and the other below, there being a flue space between the top of this and the bottom of the upper oven and fire chamber, and a diving flue between the fire chamber and upper oven, and one back of the upper oven divided into three compartments. When it is desired to heat the upper oven only, a damper at the top of the flue between the fire chamber and oven is opened, which directs the draught down this flue under the oven, and up the middle division of the back flue to the pipe; but when the two ovens are to be heated, this damper is closed, and a damper that governs the two outside divisions of the back flue are opened, which directs the draught over the top oven, down the outside divisions of the back flue, over the top of the bottom flue, down the front flue, under the oven, up the back flue of the bottom oven, and then to the pipe through the middle division of the back flue.

Claim.—"What I claim as new is the particular arrangement of the flues and valves, as set forth. I do not claim either, or any, of these, excepting under the special arrangement and combination thereof, above made known, and by which they are rendered susceptible of the various changes described."

32. For an improvement in the *Flax and Hemp Brake;* Aaron F. Bruce, Marshall, Salina county, Missouri, June 24.

This is for an improvement in the common Dutch hand brake, which consists in dividing the standards and beams, to which the swords are attached, that they may have sufficient elasticity to yield and permit the swords to accommodate themselves to the varying bulks of hemp, and prevent the breaking of the fibres. In the hand brake the hand of the operator regulates the strength of the blow, and yields whenever it is required; but as this machine is to be worked by power, and the brake has a positive motion, the yielding of the swords becomes indispensable, in the judgment of the patentee.

Claim.—"What I claim as new, is the manner of giving the necessary lateral play to the vibrating and stationary swords, so as to accommodate themselves to the varying bulk of the material, by attaching the swords to the divided beams, and divided standards, as described."

33. For improvements in machinery for *Cutting and Dressing Stone;* Jacob Jenks, Roscoe, Winnebago county, Illinois, June 24.

The patentee says,—"The nature of my invention consists in a cutting tool that extends across the stone, said tool having a row of picks on its front edge, and just behind them, a broad chisel, the tool being vibrated, and by its weight and momentum, cuts the stone which passes under it on a carriage; side cutters of a similar construction are attached, and vibrate horizontally to cut the sides of the stone."

These cutters are attached to stocks that vibrate on centres, and, therefore, the picks and chisels cut by a vibrating circular motion communicated to them by appropriate machinery.

Claim.—"What I claim as my invention, is the cutter-head, constructed and arranged as described, having chisels and picks attached thereto enough to extend across from one side of the stone to the other in a line, and all operating at once the whole width of the stone, in the manner and for the purpose described. I also claim, in combination therewith, the side cutters constructed and arranged as above specified."

34. For an improvement in *Piano Fortes, Harps, and other String Instruments;* Lovering Ricketts, Baltimore, Maryland, June 24.

Instead of attaching the strings to pins, in the usual manner, they are hooked on the end of metallic springs, which project from studs attached to the instruments. The inventor states that his object is to keep instruments in tune, by the elasticity of the spring connexion, which yields as the strings contract.

Claim.—"What I claim as my invention, is the application of my metallic springs to the piano, harp, and all other musical string instruments, as an improved substitute for the common hitch pins now used, and for the purpose of keeping them in tune for a long period of time."

Patent Re-issued in the month of June, 1844.

For improvements in *Boxes for the Journals of Railroad Cars, &c.;* John H. Tims, Newark, Essex county, New Jersey, June 13.

This patent was granted on the 31st of October, 1839, and noticed in this Journal at page 394, vol. xxvi, to which the reader is referred; and as the re-issue was granted for amendments in the specification, it only becomes necessary, in this place, to insert the claim.

Claim.—"I do not claim, as my invention, the supplying of oil to the journals of axles, by means of sponge, or other similar substance, as that has heretofore been done; nor do I claim the invention of a cup, or saving chamber, placed under the bearing of a journal, as cups, open and exposed to the dirt,, and from which the oil could be spilled by the jar of the car in motion, have been used; neither do I claim a washer, or cap, from the hub of a wheel, as that is now applied to common carriages; but what I do claim as my invention, is constructing the box in the manner described, having two recesses, or compartments, in its lower section, into one of which sponge, or other suitable elastic substance, is fitted, so as, when saturated with oil, to lubricate the journal with which it comes in contact, the other chamber being made to receive the oil that flows over from the first compartment, the oil being conveyed to said chambers through a conductor that enters the supply chamber under the journal; the whole being combined substantially as set forth. I also claim the particular manner in which I have constructed the journal and its bearings, grooves and cap, in combination with the foregoing lubricating apparatus, consisting of the fillet, or tongue, and the recess in the bearings for checking the lateral motion of the bearing, and the grooves and washer for retaining the oil, in combination, as set forth."

List of American Patents which issued in the month of October, 1841, *with Remarks and Exemplifications. By* CHARLES M. KELLER, *Examiner of Patents.*

(Continued from Page 72.)

22. For an improvement in *Wire Heddles;* Abraham Howe, and Sydney S. Grannis, Morrisville, Madison county, New York, October 11.

Heddles have heretofore been made in two parts, jointed together by a loop at, or near, the eye through which the warp passes, which has been alleged to be an objection, and the improvement in question is for making them in one piece, or in two pieces, jointed at the ends.

Claim.—"What we claim is the making of such heddles in one continuous piece from end to end without a joint, and this we claim whether said heddles be made of one entire piece of wire recurved at one end, to form the end eye, or of two pieces of wire, each having the end eyes formed by twisting the ends of the wires round in the ordinary manner."

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23. For an improvement in the *Spiral Water-Wheel;* John G. Garretson, Muhlenburg, Pickaway county, Ohio, October 11.

This wheel is formed in the manner of an Archimedean screw, but placed with its shaft vertical, so that it acts directly by the gravitating force of the water; and the edges of the spiral buckets, or the screw, take into cogs on a wheel, (called by the patentee the "waiter wheel,") by which the power is to be transferred to a mill, or other machinery.

Claim.—"Now what I claim to be my invention, is the combination of the spire wheel, and the case surrounding it with the wheel which I denominate the waiter, the whole being constructed and operating in the manner set forth, forming a propelling power for mills and machinery receiving and transmitting the power of descending water."

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24. For an improvement in the *Parlor Stove;* Joseph Feinour, Jr., Philadelphia, Pennsylvania, October 11.

We make the following extract from the specification, viz.,—"Upon a quadrangular, or other suitably formed, pedestal, I place a cylinder of sheet-iron, within which is contained the fire place; the lower part of this, which is to contain the fuel, is a low cast-iron cylinder that is lined with fire clay. The pedestal contains the ash-pit drawer, and extends back, so as to receive air in its rear part, four tubes, or colums, through which the draught from the fire may be directed, the upper ends of which enter a heated air chamber similar in dimensions to the pedestal. The fire chamber is surrounded by a cast-iron cylinder, or rather a conical body, which, with the fire chamber, is surrounded by the sheet-iron cylinder that forms the exterior of the stove. The fire grate turns upon pivots, as is well known, and may be shaken up and down. There is a space between the outer cylinder and fire chamber, for the passage of heated air, which is supplied to it by a pipe that passes through the pedestal, to take the air from near the floor, or out doors. This pipe opens into the cylinder, so as to cause the cool air to strike against the fire chamber, and, when heated, passes into the room through apertures in the cylinder. Immediately above the fire cylinder, and contained principally within the hot air chamber, is an air heater, closed at its lower end, which is exposed to the direct heat of the fire, except that there is an opening into its lower part, by means of a pipe from the exterior of the sheet-iron cylinder, which opening admits air from the room that will become heated, and escape into the room through a grated cover. The pedestal behind the ash drawer forms a draught space for heated air, which may be made to descend two of the columns leading from the upper hot air chamber, and to ascend the other two on its way to the exit, or smoke, pipe, which leads from the hot air chamber into a fire place. By means of a valve in the upper hot air chamber, a direct passage may be allowed from the fire to the exit pipe. There is also a pipe in the pedestal, behind the ash drawer, which forms a part of a partition dividing the pedestal into two chambers, and which, when it is desired to lessen the force of the fire, may be opened for that purpose, whilst the upper door of the stove may remain closed. The air that enters at the opening of the ash drawer will then pass directly back to the columns behind the stove, instead of through the fuel, preventing its free combustion, and the escape of gas into the room, which is apt to occur when the upper door is opened."

Claim.—"What I claim is the arranging of the damper between the ash-pit and the heated air chamber of the pedestal, for the purpose described. I claim the manner in which I have arranged and combined the fire chamber, the cast-iron cylinder, or cone, the sheet-iron cylinder furnished with openings, and the cool air pipe leading into the space, in the manner and for the purpose made known. I claim the manner of arranging the air heating cylinder above the fire chamber, and passing through the heated air chamber, having also an opening into it for the admission of air, and being furnished with a grated cover for its escape, after being heated in its passage through the cylinder."

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25. For improvements in the *Rotary Steam Engine;* L. A. Stewart, Cross Plains, Robertson county, Tennessee, October 11.

This is for improvements on Murdock's rotary engine, patented in England some forty years since, in which the steam acts against the cogs of two wheels. The improvements are pointed out with sufficient clearness in the claims.

Claim.—"What I claim is the manner of constructing, combining, and arranging the cap and cheek pieces, so as to embrace under the cap but a small portion of each wheel, employing the cap and cheek pieces, in lieu of the close case, or cases, hitherto used in such machines, and introducing the steam through the caps between each pair of wheels. I claim the combining with these caps the weighted levers for pressing them down on the teeth of the wheels, thus preserving them in close contact, without the necessity of any elastic packing. I claim the manner of preventing binding, or cramping, in said pairs of wheels, by the combined operation of the end play of the axles of two of them, and of the play of one of them in the direction of its revolution. I claim the using of the steam on a second pair of wheels, by conducting it from the first pair through the cap of the second pair, in the manner set forth."

26. For improvements in the machine for *Planting Seeds;* Joseph Jones, Newton, Gloucester county, New Jersey, October 11.

We have here alleged improvements on that kind of planting machines in which the seeds are carried into the dropping tube from the hopper by means of a slide; and the first improvement consists in placing the rest board, on which the slide works, directly under the aperture in the hopper, so as to leave a passage into the dropping tube on each side of the rest-board, that seed may be discharged on either side at each back and forward movement of the dropping slide. The covering roller has its bearings in two arms jointed to the frame, and to two segments provided with a set screw, by means of which the depth of the machine may be regulated.

Claim.—"What I claim, is, first, the method of combining the rest board with the spout and slide, by arranging the rest board over the centre of the spout under the slide, so as to leave a passage at either side of the board for admitting the seed into the spout on both the forward and backward motion of the slide; and in combination with said arrangement the method of adjusting the rest board by means of screws; second, the combination of the arms, segments, and screws, for adjusting the height of the roller for causing the plough to enter more, or less, as well as for rolling, as described."

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27. For an improvement in the *Hydraulic and Pneumatic Cock;* John Lee Chapman, Baltimore, Maryland, October 11.

There is a cylindrical hole in the head of the cock, extending from, and at right angles to, the aperture, for the passage of the fluid, in which slides a cylindrical plug, having the lower end made conical, to fit into a conical recess in the body of the cock, and intercepting the aperture for the passage of the liquid. The conical and cylindrical parts of this plug are covered with leather packing, and the upper end is squared to fit and slide in the cap, which is screwed on to the head with leather packing interposed; and this cap has another cap screwed on to it, for the purpose of retaining the key, by a flanch on the body of it, which is tapped into the upper end of the plug, for the purpose of working it up, or down, to open, or close, the aperture.

Claim.—"I claim the manner of forming the plug, and the chamber within which it operates; the lower part of said plug being made conical, and adapted to the closing of the passage of fluids through the cocks; and the upper portion thereof being cylindrical, and so packed as to be rendered air and water-tight, substantially in the manner and for the purpose herein described. And I do hereby declare that although I have represented and described the particular manner in which I put the respective parts of the instrument together, and which I consider to be the best arrangement thereof, I do not intend to limit, or confine, myself to this precise mode, but to vary the same as I may think proper, whilst the part upon which the severe action of the cock is dependent, are combined and operate substantially as set forth."

28. For improvements in *Self-Acting Mules, Billeys, Jennies, Jack Frames, &c.;* Richard Roberts, Manchester, England, October 11.

We are under the necessity of omitting a descriptive notice of this invention on account of its complexity, as the attempt to give any idea of its character, in the narrow limits of a sketch, would be vain. This omission is the less to be regretted, from the circumstance that the description and drawings will be found at large in the *Repertory of Patent Inventions;* but we insert the claim for the benefit of those who are acquainted with the mechanism, and who may desire to be informed of the limits of the letters patent granted in the United States.

Claim.—"Having described my improved mechanism for adapting the rotation of the spindles to the regular taking up of the yarn as the form and diameter of the cop changes, throughout the operation of winding on; I do hereby declare that my invention consists in the method, or means, to be employed for that purpose herein before described. The mechanism thus employed by me effects the rotation of the spindles in two ways; first, rotary motion is given to a drum, or barrel, which turns the spindles, whilst the carriage is running in, by uncoiling from it a portion of a cord, strap, or chain, attached to the drum, and having its other extremity fastened at some point in a radial arm which describes an arc, whilst the winding on drum is receding from the point of attachment of the cord in a right line. This compound motion adjusts the rotation of the spindles to the varying power of taking up by the conical cop, as the yarn, or roving, is being coiled on its different diameters during the winding on of each stretch. Secondly, during the progress of the formation of a cop the situation of the point of attachment of the uncoiled end of the cord, strap, or chain, on the radial arm, is changed progressively, as the increasing bulk of the cop demands fewer revolutions of the spindles to take up the stretch, and, consequently, there is a shorter length of the cord to be uncoiled from the barrel. And I declare that the form and proportions of the different parts of my improved mule, as well as the materials of which the same may be composed, may be varied according to the discretion of the workman employed in constructing the same, without departing from the object and principle of my improvements."

29. For an improvement in the *Boiler, or Caldron;* Lansing E. Hopkins, New York City, October 11.

The fire place, or furnace, is surrounded by a boiler, except where the door for the fuel is placed, and the smoke pipe, or chimney, passes out through the top of the boiler, and the caldron is let in the top of the boiler, so that its bottom and sides are exposed to the direct action of the vapor in the upper part of the boiler.

Claim.—"What I claim is the particular manner of arranging and combining the furnace, the steam boiler, or generator, and the caldron; the general form and arrangement of these parts being substantially the same with those described; without, however, intending, by the accompanying description and representation, to limit myself to any precise shape, or proportions, of the respective parts, but to vary these as I may find convenient."

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30. For *Pneumatic Springs applied to Railroad Cars;* Levi Bissell, Newark, Essex county, New Jersey, October 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of compressed air, or other permanently elastic fluid, in a cylindrical, or other shaped, vessel, made of metal, or other hard substance, and acting against a piston working therein, for the purpose of springs for railroad cars, or other carriages "

It may be well to say, that at the time application was made for letters patent for this supposed invention, the applicant was informed that it was known to the officers of the department, that this device had been applied to carriages, and used for various other purposes, as a substitute for metal springs; but that after a diligent search in the records of the office, and the library, which, unfortunately, is too limited, no evidence could be found, such as the law requires the commissioner to furnish, on refusing to grant letters patent, and that, therefore, it was optional with him to demand one, or withdraw his application; that he might, however, rest assured that if he did obtain a patent he would not be able to sustain it. He did insist on the grant, and some time afterwards he was furnished with the evidence of the want of novelty.

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31. For an improvement in the *Elevated Oven for Cooking Stoves;* Rensselaer D. Granger, Albany, New York, October 11.

Claim.—"What I claim is the manner in which I have constructed the elevated oven by extending flat flues at either end by means of end plates, arranged and operating substantially as set forth; the heated air from the fire chamber entering the lower flue, and escaping from the upper, in the manner described."

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32. For a mode of rendering the *Pockets of Garments Safe against Pickpockets;* Daniel Harrington, Philadelphia, Pennsylvania, October 11.

The surface of the pocket is covered with fine metallic chain, or with metallic, or other buttons, or quilted with metallic wire. And to prevent a pocket, &c., from being cut away, one, or more, strands of chain are carried from the pockets to some other part of the dress. These are described as applicable to reticule bags, and other similar bags.

Claim.—"What I claim as my invention, is combining pockets constructed substantially as described, with the various articles of wearing apparel set forth."

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33. For improvements in the *Cooking Range;* N. P. Kingsley, Boston, Massachusetts, October 11.

"The object of these improvements is to so combine the parts of a cooking range as to secure conveniences for effectually performing the several culinary operations of roasting, baking, boiling, &c., and at the same time to warm the building, by heating and diffusing hot air through the apartments, which air shall not be charged, or mingled, with the effluvia which are necessarily produced by the various cooking operations."

The fire chamber, or fire pot, is semi-cylindrical, with the flat side to the front, and the curved part inclosed by two side flue spaces; it has a grate at the bottom, and one on each side, communicating with the side flue spaces; and from these side flue spaces there are two branch pipes that lead from opposite sides into the main draught pipe which runs directly from the upper and back part of the fire pot. The cold air enters from the back, passes around partitions, and enters and circulates around the side flue spaces, pipes, oven, &c., and passes off to the apartments to be heated; and the gases, &c., from the cooking are carried off through pipes above the oven and cooking pans, &c.

Claim.—"I shall claim, first, forming two side gratings in the fire pot of a cooking range communicating with two flue apartments on the sides of the same, through which gratings the smoke, &c., may pass to the said apartments; the whole being arranged and operating substantially in the manner. and for securing the effects herein before specified. Secondly, the method of combining the semi-cylindrical fire pot, (having grated openings,) with the flue spaces on either side of it, by arranging the flat surface of the pot on a line with the plates constituting the fronts of said spaces, so as to form a part of the front of the range, and covering both the fire pot and flue spaces with a top plate, so as to form a chamber on either side of the fire pot—the surface of the fire pot forming a portion of said chambers as described."

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34. For an improvement in the *Condenser of a Woolen Carding Engine;* Levi L. Gowdy, Montgomery, Orange county, New York, October 11.

Between the carding cylinder and condensing tubes, there is a set of vertical separators, or rods, and two horizontal rollers to separate the strands of roping, and prevent them from twisting together.

Claim.—"What I claim as my invention, is the application to the condenser of the woolen carding machine of a series of separators, in combination with two rollers placed between the tubes and cards, for the purpose of separating the strands, or roping, and preventing them from being twisted together."

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35. For improvements in machinery for *Grinding, Moulding, and Pressing Clay into the form of Bricks;* Charles G. Brown, Caldwell, Rockland county, New York, October 11.

The clay is mixed in a tub by means of arms attached to a vertical shaft rotating within it, and is forced out into the moulds at the side and on a level with the bottom; the moulds being carried under the press and conveyed away by an endless chain.

The claim refers throughout to the drawings, which are numerous and complex, and could not be understood without them, and, therefore, we are under the necessity of simply pointing out to what improvements it is confined and limited. The first, is to the employment of clack valves fitted to openings in the driver of the press, to admit air on the rising of the driver, and thereby prevent the brick from adhering to it. The second is to a mode of regulating the pressure by having the rod of the driver made in two parts sliding on each other, and connected together by a cord passing around pulleys on both, and connected to a weighted lever, so that in case of any impediment to the movement of the driver, the part of the rod in connexion with the power, will lift the weighted lever without moving the driver. The third is to an arrangement and combination of latches, catches, and levers, for moving the endless chain that carries the moulds. The fourth, is to a mode of preventing breakage by hard substances obstructing the motion of the endless chain carrying the moulds, by connecting it with the lever, that moves it by means of a weighted lever, this connexion being effected by an arrangement of levers and cords. The fifth, is to the mode of constructing the metal grates with openings narrower in, or near, the middle, than at the ends, for the purpose of pressing the clay through the same, so that it shall fill the ends and corners of the mould beneath equally with the middle parts of the moulds, thereby avoiding any partial removal of the moulding sand, and preventing the clay from sticking in the moulds. The sixth, is for the mode of pressing the bricks by the momentum of a weight on the end of a lever jointed to the driver rod, and combining with this the parts for lifting the driver, which is suspended to a lever operated on by a cam on a rotating shaft so formed as to lift the driver gradually, and liberate it suddenly. The seventh, is to the mode of adjusting the moulds in place to be sent on under the pressing chamber, to be filled by a spring on one end, and a gauge bar moved by a lever and parallel links. The eighth, is to the mode of driving the moulds under the press chamber, by means of a driver and arms on a rock shaft, in combination with a vertical rod, and a cam on a horizontal shaft at the top of the machine; and the ninth, is to the mode of preventing breakage from hard substances passing through the grates into the moulds, so as to obstruct the moulds by a combination of parts connecting the whole with a weighted lever.

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36. For an improvement in the *Self-Oiling Bush for Mills;* George M. Copeland, Genoa, Delaware county, Ohio, October 11.

The curb, or inner periphery, is so formed as to leave a space for packing between the bush and spindle, and is provided with apertures to admit the oil to percolate and pass to the packing from chambers on the outside.

Claim.—"What I claim as my invention, is making a space within the curb to admit packing around the spindle, as described, and in combination therewith the openings from the reservoir cups to supply oil to the packing, as described."

37. For an improved mode of preventing *Cotton, or Wool, from falling to waste from the Carding Machine;* Joseph Munroe, Palmer, Hampden county, Massachusetts, October 11.

The patentee says,—"The nature of my invention consists in providing the under side of the carding machine with a screen, or sieve, in such a manner that the dirt, which the cotton, or wool, contains, may fall through the screen, while the cotton, or wool, is kept in contact with the cylinder of the carding machine by means of the screen, and not permitted to fall down under the machine, and go to waste."

Claim.—"What I claim as my invention, is the application to carding machines of a screen which will permit the dirt, motes, &c., to escape, without the cotton, or wool, as described."

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38. For an improvement in the *Jaws of Bench Vices;* William Sim, Schenectady, New York, October 11.

This is for making cast-iron bench vices with steel jaws, or facing the jaws with steel, by casting the body of the vice on to the steel plates, which form the facings of the jaws.

Claim.—"I claim the manner in which the steel face, or lip, of the jaws, as described, is formed and constructed, and the manner of joining the lip thus constructed of steel to the jaws, by casting the lip of steel separately with three, or more, holes, and then placing the steel lip in the mould where the jaw is to be formed, and in this manner uniting the lip of steel to the iron jaw, thus forming the jaws of distinct metals, and in a simple and durable manner, as described."

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39. For an improvement in *Railroad Cars for Running on Curves;* Perry G. Gardiner, assignee of Isaac Bullock, New York City, October 11.

This improvement is for the purpose of throwing the axles of the wheels in the radii when the car passes over a curve; each wheel is on a separate axle, that has its bearings in a frame extending from the outside to within a short distance of the middle of the truck frame. The outer ends of the wheel frames are jointed to the truck, and the inner end of the right hand back frame is connected by a joint rod with the inner end of the left hand forward frame, and the other two in the same manner, and the inner end of the two back frames are connected with the two T arms of a T lever; the third arm of which is for the front car, attached to the axle of two leading, or guide, wheels, and for the other cars, to the back of the preceding car, and for the back truck of double truck cars, to the back of the front truck. From this arrangement, it is evident that the moment the (*t*) lever is, by the leader, or preceding car, thrown in the direction of the radii, the axles of the wheels must, of necessity, follow."

Claim.—"I do hereby declare, that I do not claim the mere cutting of the axle into two parts, so as to run independently of each other, nor do I claim running each wheel in a separate vibrating frame connected with the frames of the other wheels, by means of connecting rods, these having been done, but without the farther connexion hereafter claimed; but what I do claim as constituting my invention, and desire to secure by letters patent, is so connecting the sliding boxes, (for the frames in which the wheels revolve,) by means of connecting rods with a lever in the form of a cross, or letter T, (which connects the car with the next preceding car, or in case two, or more, trucks carry one frame, may connect the said trucks with the said frame,) as to adjust all the wheels simultaneously, and enable them to receive the adjustment from the preceding car, or frame, or from the frame of the car itself when two, or more, trucks carry one frame, all substantially, as described."

40. For an improvement in the *Valves and Pistons of Pumps;* John Clark, Portsmouth, Norfolk county, Virginia, October 11.

The nature of this improvement is distinctly pointed out in the following—

Claim.—"What I claim as new, is the attaching of the pistons and valves, the former to the piston rod. and the latter to a rod, or bar, of metal, by a joint pin out of their centres, by which they will be enabled to tilt, and allow the passage of water upwards, and will resume their horizontal position when the water, or other liquid, is not ascending within the pump; the said valve being made so as to occupy the whole section of the barrel of the pump, and the arrangement and operation of the respective parts being substantially such as are described and made known."

41. For an improvement in the *Steam Boiler for culinary purposes, &c.;* Solomon C. Riley, New York City, October 11.

The fire is contained in a cylinder, or pot, which is surrounded by another cylinder, leaving a space between the two for water, which constitutes the boiler. The space uniting the two cylinders at top may be provided with cooking holes, and a steam pipe, and the top of the fire cylinder may be adapted to receive either a caldron, or a plate, with several boiler holes.

Claim.—"I do not claim the discovery of a double cylinder, or the use of the caldron; but what I do claim as new, is first, the combination of the double cylinder, boiler, and caldron with the space between the double cylinder left open at top. Second, the same with a cap pierced with kettle holes, for the purposes described."

42. For an improvement in *Traveling Trunks;* John Fitzgibbons, Philadelphia, Pennsylvania, October 11.

Claim.—"What I claim as new, is the constructing of trunks, and other articles of similar character, with their front and back sides rendered alike in appearance, by covering the key holes with screwed knobs, resembling the rows of knobs used to ornament and strengthen such articles, and by making the strip which forms the cover of the opening between the lid and the lower part of the trunk of hoop iron, or other rigid substance, covered with leather, or other suitable material, and by riveting the back straps of the hinges to said strip forming the ledge, and by otherwise arranging the respective parts in the manner set forth; these parts being claimed only in combination with each other, so as to attain the end which is the object of this invention."

43. For an improved *Apparatus, or Instrument, for Counting Coins, and other articles of similar character;* Philos B. Tyler, executor of Rufus Tyler, deceased, Branch Mint, Louisiana, October 11.

This instrument consists of a square board, or plate, with parallel strips, or ledges, projecting from its surface about the thickness of the coin to be counted, and at distances apart equal to the diameter of the said coin, and at one end there is another ledge, or strip, at right angles to the parallel ledges, thus forming troughs, or receptacles, for the reception of the pieces of coin.

Claim.—"What is claimed, is the described manner of dividing the face of the instrument into a series of separate shallow troughs, by means of the strips of metal, in combination with the strip placed at one end thereof; said strip not rising higher than the thickness of the coin to be counted—the whole being arranged, combined, and 'ememployed for the purpose, and substantially in the manner made known."

Improvements added to previously granted Letters Patent, during the month of October, 1841.

1. For improvements in the *Counter Twist Speeder;* Jesse Whitehead, Manchester, Chesterfield county, Virginia, October 11.

This is for improvements on a counter twist speeder patented to Jesse Whitehead on the 29th of May, 1841, and noticed in this journal at page 51, of the fourth volume, third series, to which the reader is referred.

The first improvement is for making a groove in the revolving block, or roller, which receives the roping from the condensing belt, and conducts it to the bobbin, instead of the curved and grooved guide, described in the original patent. The second, is for the method of doffing the spools, after they are filled, by means of a plate which projects from a horizontal shaft, and which extends under the spool, the shaft being provided with a handle, by which the plate is brought up under the spool, and lifts its journals from the forks in which they work, and permits it to roll back on to a table, thus leaving a portion of the roping on the plate in a convenient position for the operator. And the third improvement is for hinging the guide, which is placed between the grooved block, or roller, and the condensing belt, so that it can be thrown back when the operator wishes to introduce the roping in the groove of the block, and which also permits it to yield when a knot in the roping passes between it and the block, or roller. We are under the necessity of omitting the claims, as they refer to the drawings, and could not well be understood without them.

FRANKLIN INSTITUTE.

Extracts from the Reports of the Judges appointed to examine the Articles offered at the Fourteenth Exhibition of American Manfactures; held October, 1844.

Report on Silk Goods.

Although nothing particularly new, or remarkable, in the article of Silk has been submitted to your committee, yet it is highly gratifying to notice the continued efforts to advance so interesting and important a branch of manufacture; and when we contrast the incipient stages of the manufacture of cotton, with the great perfection to which it has now attained among us, we cannot but feel encouraged to hope, that the active and untiring genius of this people will yet place the silk manufacture in the fore-front of the productions of this country.

Report on Musical Instruments.

The number of piano fortes at the exhibition is smaller than it has been for several years, and the improvement which they indicate in the art of manufacturing them is not remarkable. Several of the instruments were, however, of excellent character, well made, and, in all respects, such as to confirm the opinions heretofore expressed in favor of the establishments from which they come. Those from Mr. Gale, of New York, and Meyer, of Philadelphia, are of this class. The committee, however, do not think themselves justified in asking for these, or the other exhibitors, among whom several presented good specimens of work, any of the marks of distinction within the power of the Institute.

The improved double action harp (No. 2028, exhibition number,) may fairly challenge rivalry with the best imported instruments of the kind. Its plan of construction, workmanship, tone, and appearance are worthy of very high praise. The only doubt that has arisen in the minds of the committee as to the propriety of awarding to it the Institute's medal, originates in the fact, that in an engraving upon the body of the instrument the maker's residence is said to be in *London*, and the decorative engravings on the reverse are to the same effect. Evidence has been presented to the committee going to show that the instrument is, *in fact, American;* as is declared also by the engraved plate which covers the European inscription, and that the London mark, which is that of a branch of the same establishment, was assumed merely as a *sale mark*, in consequence of the general want of reputation of American harps. If the committee on exhibitions find, in this circumstance, no objection to the grant of the medal, then the undersigned would recommend that the medal should be awarded to No. 2028.

The evidence, presented by the exhibitor of the harp, is herewith submitted. It is probably intended to cover the whole ground of

American character. It may be made clearer, however, by distinct proof, that the mechanism of the instrument, which is found between the two engraved plates at the top, and includes the most difficult, and, therefore, most meritorious part of it, was itself made in this country. This remark is not made in a jealous spirit, but with the view of guarding both the manufacturer and the Institute from insidious criticism hereafter.

The wind instruments from Mr. Weygandt were, as heretofore, meritorious.

Report on China, Glass, and Earthenware.

The judges on china, glass and earthenware, respectfully report, that but two invoices were entered on their list; these were, of glass ware:

No. 1036. Made by M. & R. H. Sweeny, of Wheeling, Va., deposited by Jos. Bell—an invoice of flint glass, comprising one very large and beautiful covered bowl, fruit bowls, celleries, pitchers, decanters, tumblers, and wine and jelly glasses, all richly cut. This glass is of uniform quality throughout, remarkably clear and brilliant, and will compare favorably with the best ever brought to these exhibitions. The judges recommend the award of a silver medal to this lot.

No. 1051. Made by The Boston and Sandwich Glass Co., deposited by Wm. M. Muzzey—an invoice of colored glass, far surpassing in excellence, any colored glass ever before made in this country. The amber, carnelian and ruby have been imparted with such admirable success, that there is but little room left for improvement, and the combination of colors in some of the specimens, has produced tinges exceedingly beautiful. The specimens of opaque glass of various colors and shades, are new and eminently successful. The judges recommend the award of a silver medal to The Boston and Sandwich Glass Co., for their success in the manufacture of colored glass.

The display of glass at this exhibition, though small, has not been surpassed in point of interest. The manufacturers say they have been so busy making goods to order, that they have been unable to furnish many for exhibition; which, it is presumed, is the best evidence they desire that the art is flourishing.

The samples furnished by the Messrs. Sweeny, prove that the difficulty heretofore experienced in producing good color and brilliance in the article, west of the mountains, has been overcome; and that they are now prepared to furnish the best and purest flint glass.

We have been dependent on foreign manufacture for our colored glass in a great measure, but the Boston and Sandwich Co., who have erected a furnace on purpose for making it, have shown, that henceforth it will be unnecessary to go from home for any description of the article. It is not a large item in our commerce, but it is an item, and consequently a step advance in the manufactures of our country.

Report on Chemicals.

The committee of judges upon Chemicals respectfully report, that in their opinion, the Institute has great reason to be gratified by the variety and excellence of the preparations, although they regret to notice the absence of several names which have generally graced their display.

No. 503, extract of indigo, by A. Gunn; a very neat form of exhibiting the dye, and worthy the attention of manufacturers. The committee cannot go into such an investigation as must be necessary to decide fully upon its merits.

No. 505, indelible ink with mordant, Potts, Linn & Harris.

No. 506, indelible ink without mordant, Barnhill.

As to the merits of these nothing but long experience can decide; the specimens of writing look well. One of the committee has tried No. 506, and speaks favorably of its color.

No. 509, sugar, from Lovering & Co.; a very beautiful, white, and crystaline sugar; remarkable for the size of the grain, and for the purity of its color. Its appearance sustains the reputation which the manufacturers gained at the last exhibition.

No. 518, spermaceti, Alexander H. Campbell; a preparation of exceeding beauty and purity, and well worthy the attention of every one.

No. 521, chemicals, by Dilwyn Parrish; a lot of very excellent chemicals, all of which deserve credit. A small bottle of bromine apparently belonging to this lot, but made by E. Gillespie, possesses great interest on account of its novelty as an American manufacture, and its apparent purity.

No. 524, magnesia calcined and fluid, by Thomas J. Husband; the articles look very well, and your committee regret that their time will not allow them to test their purity. The calcined magnesia appears very light, white, and free from grit, or lumps; and if it can be substituted for Henry's, as the manufacturer asserts, will be of great importance. The plaster exhibited by Mr. Husband is not within the province of a chemical committee.

No. 525, three small bottles of chemical preparations, by J. Taylor; the iodide of lead is very beautiful, but the specimen is not large enough; the others are not worthy of note.

No. 532; Edward Pryor exhibits oils of hemp seed and peach kernels, both excellent preparations, but not important unless they can be made cheaper than that imported, of which your committee have not the means of judging.

No. 535, cyanide of potassium, by H. Worthington; a beautiful preparation, and superior in appearance to either of the other specimens of this substance exhibited.

No. 536, chemicals, by Smith & Hodgson; a fine display of beautifully prepared articles, among which the biniodide of mercury, mosaic gold, chromic, and gallic acids, are peculiarly deserving of note.

No. 537, chemicals, by William Procter, jr.; all these preparations are excellent, and several very superior; the committee would advise, however, more attention to extracting the coloring matter, which would add greatly to the beauty of their appearance.

No. 539, Seidlitz powders, &c., by Haskell & Merrick; these are neatly put up; would appear to be very convenient, and will, doubtless, be found very agreeable.

No. 547, a lot of mustard and spices, from the Messrs. Fell; the articles are neatly prepared and well put up, and will be found convenient for family use, but of their peculiar excellencies the committee are not able to judge.

No. 548, chemicals, by Edwin Parrish; they are generally very good specimens of preparation. The tannin is lighter in color than any other specimen shown.

No. 551, chemicals, by Farr, Powers & Weightman; this is decidedly the best lot of chemicals exhibited, and derives increased interest from the fact, that they are manufactured upon a very large scale. The committee would call attention especially to the samples of quinine, calomel, and corrosive sublimate, by two different methods.—These articles are merely the commercial articles of this firm, such as they sell to their ordinary customers, and the committee deem them deserving of the highest approbation.

No. 552, pine oil or camphine, manufactured by Benj. T. Davis; this is a very superior article, entirely colorless and transparent, with comparatively a faint smell, and great purity, as is indicated by its preservation of its properties in open vessels; the committee judge it to be worthy of high praise.

No. 553, a box of beautiful isinglass, by Delacour.

No. 561, a lot of chocolate and cocoa, from the manufactory of G. Schmitz; it looks, smells and tastes well, but the committee cannot go into any nice investigation of its merits.

No. 577, a box of starch, by Altemus; appears to be very white, soft and pure.

No. 580, polishing rouge, by Mrs. West; the article seems to be very good, being well prepared and free from grit; it has a little acidity, which is probably not injurious to its good qualities; it is deserving of praise.

Nos. 502, 522, 549, and 578, perfumery, by Messrs. N. B. Hinton, Hauel, Roussel and A. E. Wetherell. Roussel still maintains a decided superiority in his perfumery over his competitors, although Hauel has very much improved upon his exhibition of last year; the committee, however, regret to see upon his stand bottles of extracts, purporting from the label to have been manufactured in Paris. Such extracts are not proper subjects of exhibition in the Institute, and should have been, in the opinion of your committee, excluded. The judges have taken no notice of them in instituting their comparisons.

Nos. 528 and 564, soap, by Messrs. H. P. & W. C. Taylor and J. R. Graves; these gentlemen exhibit each a beautiful lot of soaps, in the manufacture of which, a decided improvement is very visible. Messrs. Taylors' collection consists entirely of the pure transparent soap, while Mr. Graves exhibits a variety of the article as more usually employed in the arts, and offers them at prices which much enhance the importance of his display. The committee consider both these gentlemen to have deserved the approbation of the Institute, but they would especially call attention to the articles of Mr. Graves, on account of their apparent excellence, and the low price at which they can be afforded.

In conclusion, the committee recommend the following awards:

No. 551, to Messrs. Farr, Powers & Weightman, for their admirable display of commercial chemicals, A Silver Medal.

No. 536, Smith & Hodgson, for a beautiful display of chemical preparations, A Certificate of Honorable Mention.

No. 518, to Alex. H. Campbell, for the excellence of his prepared spermaceti, A Certificate of Honorable Mention.

No. 549, to Eugene Roussell, for the best perfumery, A Certificate of Honorable Mention.

No. 528, to H. P. & W. C. Taylor, for their transparent soap, A Certificate of Honorable Mention.

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MECHANICS, PHYSICS, AND CHEMISTRY.

Notice of the Manufacture of Glass in Bohemia. By M. L. P. Debette.—[Annales des Mines, 4th series, volume iv, page 553; December, 1843.]

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Of Glass in General.—Every transparent, or, at least, translucent substance, which is brittle at ordinary temperatures, becomes soft and ductile, and finally melts, at a high temperature, and of which, when cold, the fracture presents a peculiar, well defined lustre, known as the vitreous lustre and the vitreous fracture, is called, in the most general sense of the word, glass. Many acids, such as the phosphoric and boracic, as well as many silicates, phosphates, borates, arseniates, fluorides, and some metallic chlorides, such as those of lead and silver, different mixtures of these bodies with each other, and with other substances, among which the alkalies and the earths hold the first place, give glasses by their fusion. That which in the arts is more especially meant by the term glass, is a compound of silica, potassa, or soda, or both together, and of lime and oxide of lead alone, or mixed. This compound gives, by fusion, an amorphous and transparent mass, which is not soluble in water, nor in any acid except the hydro-fluoric.

History.—According to Pliny, the discovery of glass is due to some Phœnician travelers, who having, by accident, used a block of natron, (the native salt of soda,) in arranging their fire in the desert, saw, with astonishment, the two substances combine by fusion, and give a glass; but this fact cannot be admitted, the temperature required being far higher than could be obtained under such circumstances. M. Handicquer de Blancourt, one of the oldest French writers upon the subject of glass, carries the invention back as far as Tubal-Cain, because he having discovered the art of working metals, by fusion, must have obtained slags analogous to glass.

At all events, it is certain that the discovery is very ancient, for it is mentioned in the Holy Scriptures, first, in the Book of Job, chapter xxviii, verse 17, where it is written,—"The gold and the crystal* cannot equal it," &c. And secondly, in the Book of Proverbs, chapter xxiii, verse 31,—"Look not thou upon the wine when it is red; when it giveth this color in the cup,†" &c. Aristotle, in a work written in the year 384 B. C., speaks of glass, and seeks to explain its transparence. Fourteen years later, in 370, Theophrastus mentions the glass works situated at the mouth of the river Belus; which is nothing astonishing, for the Phœnicians were the most skilful in the arts of all the people of antiquity, and had, so to speak, the necessary sand and soda under their hands.

The Egyptians were also, from the most remote antiquity, acquainted with the art of making clear and colored glasses, of cutting and of gilding them, as is proved by the glass dresses found upon several mummies from the catacombs of Thebes and Memphis. At a later period, under the Emperors, glass works were erected near Alexandria, which became very celebrated, and filled Italy with their productions.

The Romans were acquainted with glass more than two centuries before Christ; but it was as late as the reign of Nero, that the first glass works was established at Rome; and even then they made only poor drinking glasses. The fine glasses were still so dear at this time, that the Emperor Nero paid more than four thousand francs of our money (eight hundred dollars,) for two handsome glass cups. Under Alexander Severus, A. D. 210, the number of glass workers had so much increased at Rome, that it was thought proper to assign to them a particular quarter of the city.

In the middle ages, Venice distinguished itself by its glass works, which, in 1291, were transferred to the peninsula of Murano, the name of which soon became famous.. In this place, it is said, the first blown glass was made.

At this period Bohemia was the most skilful and the richest country in Germany, to which it gave its emperors. Its relations and commerce with Venice and Italy soon introduced into it the art of glass making, and the extreme purity of the raw materials, which are met with in abundance in the mountains which form a girdle around this country, soon assigned to it, in this art, a superiority and reputation which have been maintained to this time.

Traveling, in 1842, through Bohemia, I visited with interest the most renowned manufactures of glass and crystal, and especially the various groups of the Böhmerwaldgebirge. The beauty of the productions of these workshops, and the veil which still covers their processes of manufacture, have induced me to publish here the few observations which it has been in my power to make.

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* The word which in our version is translated 'crystal,' is rendered in the Vulgate 'vitrum,' glass.—Trans.

† Here again the word rendered 'cup,' in the English, is given as 'vitrum,' or glass, in the Vulgate.—Trans.

The extent of the work compels me to divide it into fifteen chapters, in which I shall treat successively—

Chapter I.—Of the composition and properties of glass.
Chapter II.—Of the choice and preparation of the raw material.
Chapter III.—Of the glass works of Bohemia generally.
Chapter IV.—Of the manufacture of table glass, (verre de gobeletterie) and that of the fine glass called Bohemian crystal.
Chapter V.—Of the manufacture of bottle glass.
Chapter VI.—Of the manufacture of window glass.
Chapter VII.—Of some particular articles made of glass.
Chapter VIII.—Of colored glass.
Chapter IX.—Of opalescent glass.
Chapter X.—Of hyalite.
Chapter XI.—Of the manufacture of enamelled cast vessels.
Chapter XII.—Of the art of cutting glass.
Chapter XIII —Of the art of gilding, silvering, platinizing, and incrusting glass.
Chapter XIV.—Of the manufacture of mirrors.
Chapter XV.— A general statistical view of the glass works of Bohemia.

Chapter I.—*The Composition and Properties of Glass.*

Glasses are silicates which must contain at least fifty per cent. of silica; the more there is of it, the more perfect, unalterable, hard, and infusible is the glass. The hardest, most beautiful, and most perfect glass is found in nature in the state of pure silica in rock crystal; but as this is fusible only at the highest temperatures which can be produced in our laboratories, such as those produced by employing Newmann's* blowpipe, or by the aid of a galvanic, or electrical, battery, it is impossible to procure it artificially. To render silica fusible, certain fluxes must be added; these fluxes are potassa, soda, lime, and oxide of lead.

Silica fuses very well with the alkalies, but the resulting glass is rapidly changed by absorbing moisture from the air. To prevent this alteration, it is always necessary, in the manufacture of glass, to introduce a certain quantity of lime, or of oxide of lead.

In the following table is given the analysis of a certain number of Bohemian glasses, which will indicate their composition with precision.

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* This is one of the thousand European modifications of Hare's compound oxyhydrogen blowpipe, every one of which is as inferior in power, as in simplicity, to the original.—Trans.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Silica,	71.6	71.7	69.4	62.8	75.9	78.85	70.	57.
Potassa,	11.	12.7	11.8	22.1	"	5.5	20.	25.
Soda,		2.3			17.5	12.05		
Lime,	10.	10.3	9.2	12.5	3.8	5.6	4.	12.5
Magnesia,	2.3							
Alumina,	2.2	0.4	9.6	2.6	2.8	3.5	5.	3.
Oxide of Iron,	3.9	0.3					0.6	1.3
Oxide of Manganese,	0.2	0.2					0.4	0.4
	101.2	98.1	100.	100.	100.	100.5	100.	99.2

(1) Bohemian glass from Neufeld; (M. Gras,) its composition is represented nearly, by the formula $Ca.S^5 + (Al.F)S^5 + (K.Mg.Mn)S^5$.*

(2) A fine table glass from Neuwelt, (M. Berthier;) it is exceedingly beautiful, and is prepared, according to M. Perdonnet, with a mixture of 100 quartz, 50 caustic lime, 75 carbonate of potassa, and a very small quantity of nitre, arsenious acid, and oxide of manganese. The presence of arsenic cannot be detected by analysis. The composition of this glass is expressed by the formula $C.S^6 + (KN)S^6$.

(3) Old Bohemian glass (M. Dumas;) its formula is $(Al.C.K)S^4$.

(4) Crown glass of German manufacture (M. Dumas;) its composition is expressed by the formula $(K.C)S^4$.

(5) Glass for mirrors (M. Dumas;) it is represented by the formula $(N.Al.C)S^6$.

(6) Another glass for mirrors (M. Dumas;) its formula lies between $B.S^5$, and $B.S^6$.

(7) White table glass from Silberberg near Gratzen; its composition is exactly expressed by the formula $2(K.\ Ca)S^5 + (Al.F)S^5$.

(8) Mirror glass from Neu-Hurkenthal, for the manufacture of cast mirrors. It shows a greenish tint in section, and softens at a gentle heat. Its composition is nearly represented by the formula $(Al.F)S^3 + 6(K.C.M)S^3$, or more simply $(K.C.Al)S^3$.

I shall give the composition of the mixtures which are introduced into the pots, when I come to describe the manufacture of each kind of glass.

Properties of Glass, Transparence, Colorlessness.—Transparence, and colorlessness are the first properties of glass; to obtain them, the materials must be employed extremely pure, and the least possible flux added; an excess of potassa gives to glass a greenish tint; soda and its salts gives it a yellow tint, and lime renders it milky. A very small quantity of the sulphate of potassa, or soda, gives it a yellowish, or blackish, brown green; iron colors it strongly bottle green, and an excess of the manganese employed to remove the coloration due to oxide of iron, gives it a bluish tint, which becomes a decided violet by the action of the solar light. If the minium employed in the manufacture of crystal contains a little copper, which very often happens, the crystal takes a slight emerald green tint; this, however, is not to be feared in Bohemia, where there is but a single establishment which makes lead glass.

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* The reader will remember that these are mineralogical, and not chemical, symbols; hence the letters signify the oxides, or acids, and not the elementary bases, as they would in chemistry.—TRANS.

Charcoal colors glass of a topaz yellow, more, or less, dark, and sometimes reaching a purple, so that it is impossible to obtain a perfectly colorless glass in furnaces which smoke, or in those which are heated by turf, lignite, or bituminous coal; and in these cases it is necessary to employ covered crucibles, as is done in the manufactory of crystal at Choisy le-Roi; it is also necessary, on this account, when in the fabrication of glass the alkaline carbonates are replaced by sulphate of soda, to add, in the crucibles a little (about one-thirteenth,) less of carbon than would be necessary to reduce the sulphate completely, and even thus but common glass is obtained by this process, since the slight excess of sulphate of soda, which must be left, gives a blackish brown tint.

Hardness, Elasticity.—The Bohemian glass is within certain limits perfectly elastic, and very sonorous; when well made it is sufficiently hard to strike fire with steel, and is scratched with difficulty. The lead glasses, on the other hand, have but little hardness, and less in proportion as they contain more oxide of lead; besides which they rapidly lose their brilliancy by use.

Fusibility, Cooling, Annealing, Devitrification.—All glass is more, or less, fusible; when it is softened by the action of heat, it may be worked with the greatest ease, and may be drawn out into threads as fine as those of the cocoon of the silk worm. Glass, when it is submitted to rapid cooling, becomes very fragile, and presents several remarkable phenomena, among which I will cite as an example Prince Rupert's drops. Glass supports variations of temperatures better in proportion as it has been more slowly cooled; thus when they have been but slightly annealed, or not at all, their fragility may be considerably diminished by annealing them in water, or, better, in boiling oil.

All glass exposed during a longer, or shorter, time to a heat sufficiently elevated, loses its transparency, and becomes extremely hard, and much less brittle than before. There takes place a phenomenon precisely similar to that which we see taking place every day by the slow cooling of the slags of our smelting furnaces, and especially in volcanic lavas. Glass with a soda base is more fusible and less hard than that whose base is potassa.

Density.—Below is given the densities of several glasses without lead:—

Old Bohemian glass (Dumas,)	2.396
Bohemian bottle glass,	3.782
Bohemian window glass,	2.642
Fine glass called Bohemian crystal,	2.892
Mirror glass of Cherbourg, (Dumas,)	2.506
" St. Gobain, "	2.488
" Neuhaus, 1812, (Scholz,)	2.551
" " 1830, "	2.563

Action of Atmospheric and Chemical Agents.—The harder and more infusible a glass is, the less is it alterable by the action of atmospheric and chemical agents, with the exception of hydrofluoric acid. Glass, which is too alkaline, attracts gradually the moisture of the air, and loses its lustre and polish. Many glasses are perceptibly attacked by a prolonged boiling with water, and *a fortiori* by acid and alkaline solutions; thus the bottle glass is frequently attacked by the tartar which is found in the wine. According to Guyton Morveau, all glass which is attacked by prolonged boiling with concentrated solutions of alum, common salt, sulphuric acid, or potassa, is of bad quality.

Chapter II.—*Of the Choice and Preparation of the Raw Material.*

The silica which is employed in Bohemia in the manufacture of glass, is obtained by calcining crystaline quartz, and afterwards pounding it while dry. The quartz is sometimes found in veins in granite and gneiss, as at Neu-Hurkenthal; but it is more frequently met with, either under the form of rolled pebbles in the torrents of Böhmerwaldgebirge, or in fragments, more or less angular, scattered through the vegetable earth, which comes from the decomposition of the primitive rocks. It is evident that these fragments are the remains of the quartzose veins, which, presenting a greater resistance, have escaped the disintegration of the granite or gneiss which enclosed them, and which have been more or less rolled in their transportation.

Those of these fragments which appear to the eye exempt from metallic matters, are bought and sent to the glass works, at the mean price of 0.65 francs per 100 kil: (6.6 cts. per cwt.) These fragments are roughly assorted at the manufactory; those of smoky quartz, called topazkies by the inhabitants, are laid aside as the purest, and reserved for the manufacture of glass of the finest quality, or crystal.

The quartz is calcined, either in reverberatory furnaces or in furnaces of a peculiar form, shown in the plate which accompanies this notice.

When the quartz has been heated to a cherry red, it is withdrawn from the fire, and thrown immediately into a large and shallow tub, the water of which may be continually renewed by a stop-cock, and its heating thus prevented: the quartz thus calcined and cooled, is picked out by hand by women, who gain 0.4 francs (8 cents) for 12 hours work. The fragments which are too large and too hard, which have not been sufficiently calcined, are broken into pieces and thrown back into the furnace: the rest is broken up into small fragments, and those parts which are perfectly white, are alone employed in the manufacture of glass. All fragments which present the least trace of metallic oxides, (ordinarily oxide of iron) are separated with the greatest care, pulverized separately, and employed upon iron wheels in grinding the cut glass.

Upon an average, 0.07 steies of pine wood is consumed in calcining 100 kils. of quartz, (1¼ cubic feet per cwt.) The quartz, after being calcined and picked out, is then pounded while dry—the pestles are armed with cast-iron heads, the weight of which varies from 120 to

150 kil: (264 to 330 lbs. av.) their play is from .5 met. to .6 met., (1.64 to 1.99 ft.) and each of them falls into a hemispherical mortar, about 10 in. in diameter, cut in a large beam which extends throughout the length of the pounding machine. The use of iron and stone mortars had to be rejected on account of the fear that the head of the pestles might detach sufficient ferruginous particles to diminish perceptibly the purity of the glass.

The powder obtained from the pounding machine is sifted, and that which remains upon the sieve is pounded over. Each pestle of the pounding machine pulverizes in 12 hours 90 lbs. of quartz.

Potash.—Almost all the Bohemian glass is potash-glass; because soda and its salts give to glass a sensible yellowish tint, and because the difference of the price of potash and soda is far less in Bohemia than in most of the countries in Europe. A small quantity of the potash used in Bohemia is made in that country; but the greater part is drawn from Hungary. There the Carpathians are covered by immense forests, the greater number of which are, in the present condition of things, unavailable, on account of the low price of fuel, and the difficulty of communication. They are, therefore, put to use by burning them standing, and withdrawing the common potash from their ashes by washing.

To obtain potash of the second quality, the preceding is treated cold by its own weight of water, then decanted; the decanted liquor evaporated to dryness, and the potash thus obtained, calcined at a heat high enough to frit it.

Finally, to obtain the finest potash, or that of the first quality, treat the potash of the second quality as before, using only one half of its weight of cold water.

It is of the greatest importance that the trees which have furnished the potash, shall not have grown upon a metalliferous soil, that is a soil perceptibly charged with metallic oxides and salts, for we know that these substances are absorbed by the sap, and that we can even imitate artificially by this process, a great number of colored woods, by causing certain metallic solutions to be successfully absorbed by woods of analogous structure and tissue.

When this is the case, the potash which is obtained by washing the ashes of the trees, although it may appear very pure at first sight, contains almost always, a sufficient quantity of metallic oxides to color the glass perceptibly, which must cause it to be rejected in the manufacture of fine glass. This remark, and the recollection that the value of the Bohemian glass depends peculiarly upon its perfect colorlessness, have caused the adoption in this country, of a process of testing, altogether different from the alkalimetic processes employed in France, which give only the amount of alkali, without at all indicating the nature and proportion of the foreign and injurious materials which it may contain. This test, which is still farther facilitated by the small size of the glass-pots, which in Bohemia do not contain more than from 120 to 200 lbs. of calcined and fritted materials, is performed by replacing in one of the pots in which fine glass is made, the potash ordinarily employed, by its weight of the potash to be tested, and comparing the articles made with the glass obtained, with glasses of known composition, made once for all, by varying the quality and quantity of the alkali.

Thus, by the perfect whiteness, or by the more or less decided shade of color of the glass obtained, the nature and proportion of the metallic impurities, and even, approximately, the alkaline contents of the potash tested, are ascertained; and thus its commercial value can be directly obtained.

In the mines of the Böhmerwaldgebirge, the prices of the different kinds of potash, per cwt., are as follows:

For common potash,	(third quality) - - -	$4 69
Fine "	(second quality) - - -	5 61
Superfine "	(first quality) - - -	6 97

Soda.—Soda is, as I have before remarked, but little employed in Bohemia, where it is used only in the manufacture of common window glass. Common soda costs $3.74 per cwt.

Sulphate of Soda.—The sulphate of soda, or glauber salts, is obtained in chemical works as a residue from the manufacture of nitric acid, by means of nitrate of soda and sulphuric acid, and it is employed only in certain glass works annexed to these establishments, (as at Gross-Luckawitz, near Chrudim,) where they make the bottle-glass retorts and matrasses used in the works themselves. (1-13 of its weight of carbon must be added.)

Lime.—The lime employed in the glass works of the Böhmerwaldgebirge, is obtained from a saccharoidal limestone, found both in Moravia and in Bohemia, (near Winterberg,) in beds enclosed in gneiss, which shews the same stratification; whilst in certain places, and especially near Winterberg, the granite upon which these beds rest, may be seen to send forth veins into them. This fact appears to demonstrate in a clear manner, that this limestone and gneiss, which are regarded as primitive by many German geologists, and among others by Professor Zippe, of Prague, are the effect of a metamorphosis due to the appearance of the granite, which has elevated the chain of the Böhmerwaldgebirge.

This saccharoidal limestone is perfectly white, and presents two extreme varieties; one of which, with broad plates and very transparent, imitates to deception, the most beautiful ancient statuary marble, (such as that of Paros,) while the other, with an extremely fine and close grain, has a greater analogy with the Carrara marble.

These limestones are calcined in the same furnaces which serve to burn the quartz, and are then suffered to slack spontaneously in the air, and care is taken to frit again the powder thus obtained, before placing it in the crucibles of the glass furnace. In the mixture, from 6 to 20 parts of calcined lime are introduced for 100 parts of silica.

Peroxide of Manganese.—The peroxide of manganese is but little employed in Bohemia, at least in the manufacture of fine glass: it serves to destroy the bottle-green color due to the protoxide of iron.

Arsenic.—The arsenic is obtained in the state of arsenious acid, from the Erzgebirge and from the Riesengebirge, where it is obtained, both as a principal product of the roasting of arsenical pyrites, and as an accessory product of the roasting of ores of tin and cobalt. It is much employed in Bohemia, especially in the manufacture of fine glass. It serves, first, to destroy the greenish tint due to a small quantity of the protoxide of iron; secondly, to destroy the topaz yellow color which the glass assumes if the furnace smokes, or if the wood in crackling should throw small sparks of charcoal into it; and thirdly, it serves to agitate the melted matter and assist the disengagement of bubbles.

Nitrate of Potassa.—Saltpetre, or nitrate of potassa, is employed in some of the establishments, together with white arsenic, to produce the same effects.

The pieces broken off in grinding, old broken glasses, glass which has been spilled upon the hearth of the furnace by an accidental fracture of the glass-pots, &c, are broken up, washed and classed according to their nature, their color and purity, and commonly employed in the manufacture of common glass. The pieces from making the fine glass alone, are used in the manufacture of white table glass.

Combustibles.—The combustible used in the glass works of Bohemia, is resinous wood, of which the prevailing species is the *kiefer*, (pinus sylvestris); this species is also the best for working glass, because it crackles least in the fire, and gives the most flame. The flanks and summits of all the mountains which form the chain of the Böhmerwald and Reisengebirge, are covered with forests of resinous woods. These forests are cut when of full growth, about every 80 or 100 years. The wood is cut during the summer, then in winter it is transported to the water courses which wind through the valleys, by means of slides made in the snow, and when these melt it is floated down to the glass works. The mean price when delivered at the establishments, throughout the whole of the Bömerwaldegebirge, is 23 cts. per cubic yard. The wood is completely dried and even slightly roasted before it is used, in cast iron boxes, heated externally by the flames which escape from the glass furnaces. I have seen but the five glass works of the Count de Buquoi, where this process has been abandoned for some fifteen years, and I do not know the motive of its disuse.

By the preliminary roasting of the wood, an economy of ten per cent. in the fuel is gained; and besides, the fire becomes much more easily regulated.

Clay for the Crucibles.—The clay employed in the manufacture of the crucibles, in the glass works to the east of the Bömerwaldgebirge, comes from Moravia; that employed in the glass works situated in the western part of that chain, is taken partly from the environs of Pilsen, in Bohemia, partly from the neighborhood of Nuremberg, in Franconia.

These clays are very white, very aluminous and but slightly adhesive; by calcination they lose nothing of their original whiteness. A specimen of the clay from Moravia, employed at *Silberberg*, in the manufacture of glass pots, gave by analysis, the following results:

Silica,	45.8,	Oxygen, 23.8,	Ratio, 2
Alumina,	40.4,	" 11.4	" 1
Water,	13.8,	" 12.1	" 1
	100.0		

Which gives for its formula $AS^2+Aq.$, which represents Triklasite or Fahlunite. Except that this clay contains no combustible matter, it presents in its composition a very great analogy with the refractory clays of Stourbridge and Stannington, the analysis of which has been given by M. Play, (Annales des Mines, 4th series, vol.III, p. 646) in a very remarkable memoir upon the manufacture of steel in Yorkshire.

CHAPTER III.—*Of the Glass Works of Bohemia generally.*

On the Situation and Composition of the Glass Works.—The principal thing to be considered in the location of glass works being the facility of procuring fuel, they seek as much as possible to establish them in the midst of forests, and upon the banks of a water course which will allow the floating of the wood to them, and upon which may be also established, at no great distance, the stamping machines, and the mills for cutting the glass, (schleifer mühle,) which are almost always driven by a water-wheel. The power of the stream of water is increased, when necessary, by putting it into communication, by means of sluice-gates, with the small pools which are met with in such quantity among the mountains. As the forests can be cut only about once in a century, it is often advantageous, after having cut off all the wood in the neighborhood of an establishment, to transfer it, for a certain time, to another place, where a supply can be more easily found, until this, in its turn, also becomes exhausted. This instability in the location of the greater part of the works, has, from motives of economy, led them to construct the buildings which enclose the furnaces entirely of wood; so that, at first sight, nothing is more miserable than the appearance of these works, which seem lost in the midst of endless forests, and which show themselves from afar off by the clouds of smoke which rise above the trees. It is only those works which are certain of what may be called an indefinite supply, such as those of MM. Meyer, situated near Moldau, which are, in part, constructed of stone.

The glass works of Bohemia are generally composed of two melting furnaces (schmelzöfen, or glasöfen,) one of which is in action, while the other is undergoing repair, so that one is always in activity.

When the establishment makes window glass, it has besides one or two furnaces (flattening kilns) to flatten the glass (strecköfen) which are placed under a separate shed attached to the works.

The store house for the raw materials is also attached to the works. The stamping machine and the furnaces for calcining the quartz and the lime, are also attached to the works whenever the stream is of sufficient power to allow it, but generally they are separate and placed at some distance either above, or below; the same arrangement is made of the shops in which the table glass and Bohemian crystal is cut, to which is also annexed the store house for the finished glass.

Melting Furnaces.—As the beauty and quality of the glass, other things being equal, depends particularly upon their perfect fusion, which takes place only at a very elevated temperature, not to be obtained except by a particular arrangement of the melting furnace, *(schmelzöfen,)* this becomes the most important part of the establishment. This furnace should be so constructed, that, 1st. A suitable and sufficiently elevated temperature may be produced; 2d. That the flame may circulate freely around the glass pots; 3d. So that the greatest useful effect may be obtained with the smallest quantity of fuel.

These conditions have led to the adoption of peculiar furnaces of an elliptical form, furnished with shelves on which the glass pots are placed. These furnaces are all nearly of the same form; but their dimensions are somewhat variable with the number and size of the pots; they hold 7 or 8. The fire-bricks which are used in the construction of these furnaces, are formed of two parts by volume of fire-clay mixed with one part of the fragments of glass pots, picked and powdered. The vault is always made of a single piece of clay.

Annealing Furnaces.—These furnaces are always accompanied by a kühlofen, or furnace for annealing the glass heated by means of the flame which escapes from the melting furnace. The annealing furnace is almost always surmounted by an apparatus for drying the wood, which is composed of four cubic boxes of cast-iron, 2.89 feet on each side, exposed on five of their sides to the flames which come from the annealing furnace by four apertures, and afterwards escape from the apertures by a single opening in the upper part.

The operation is conducted far too rapidly, for a complete drying, and even an incipient roasting of the wood is obtained in the course of one and a-half, or at the most, two hours; and it would be evidently very advantageous to slacken it by furnishing the openings which communicate with the annealing furnace with movable registers.

The length of the season is, upon an average, twenty-eight weeks, or six months.

Glass Pots.—The glass pots (hafen) used in Bavaria, are circular, and made with the greatest care; they are of two dimensions, and have no rims.

The smallest receive a charge of from 140 to 165 lbs. of fritted materials, and are used in the manufacture of fine glass, and table glass. Their dimensions are as follows:—

Internal diameter,	above	1.28 feet.
	below	1.11 "
External "	above	1.47 "
	below	1.38 "
Depth,		1.44 "
Thickness at bottom,		1.57 inches.

The large pots receive a charge of about 220 lbs. avp., and are used in making window and bottle glass; their dimensions are as follows:—

Internal diameter,	at the mouth,	1.41 feet.
	at bottom,	1.25 "
External "	at the mouth,	1.67 "
	at bottom,	1.57 "
Depth,		1.7 "
Thickness at bottom,		1.87 inches.

The paste of which these pots are made is composed of a mixture of very aluminous fire-clay, of which I have given the analysis above, and of very pure quartz pulverized in a dry state; sometimes they employ, as a cement, the remains of old glass pots broken up and picked, and then pulverized. After kneading the paste with the feet, in order to make the mixture as thorough as possible, the pots are formed by means of a small wooden beater, and a mould also of wood, which allows the workmen to give them accurately the same exterior dimensions. These crucibles last very differently; at Swartzthal, they last, upon an average, six weeks; at Silberberg, Winterberg, Leonorenhain, about twelve, or sixteen, weeks, and sometimes more. These crucibles after having been sufficiently dried in the air, are baked in the annealing furnaces, or very rarely in a separate furnace. When a change is necessary, they introduce them during the working season, by one of the embrasures which is made of sufficient size for this purpose, and larger than the others. Of course the new crucibles are brought up to a white heat before being placed upon the furnace shelf.

The analysis of a selected fragment of the glass pots used at Silberberg, gave me—

Silica,	61.0	Oxygen,	31.7	Ratio, 3
Alumina,	39.0	"	10.8	" 1
Oxide of iron, a trace.				
	100.			

Very white particles, which appeared to be small grains of quartz, could be seen with the naked eye in the paste.

Another Bohemian glass pot, whose locality is unknown, gave M. Berthier, upon analysis,—

Silica,	68.0	Oxygen,	35.4		Ratio, 4
Alumina,	29.0	"	8.1	9.	1
Oxide of iron,	2.2	"	.6		
Magnesia,	0.5	"	.3		
	99.7				

By use the substance had become excessively hard, of a light gray, and was filled with an infinity of small globular cavities, which indicated a commencement of fusion, and presented besides a multitude of small very white grains, which showed themselves very plainly upon the grey ground of the mass.

Flattening Kilns.—These kilns are either isolated or placed together two by two; I have been informed that there are some placed together in fours. They are always composed of a flattening kiln, (strecköfen) into which the flame comes from the fire-place by four small chimneys, placed at the end of the bottom of the kiln, and which communicate with an annealing furnace, into which the flame passes from the fire-place by a single opening only.

Of the Persons Employed.—The persons employed in a glass works consist, 1st. Of a director, (buchhatter) who superintends the works, keeps the books, receives orders, forwards the goods, pays the workmen, &c.

2d. Of the workmen employed in transporting and preparing the raw materials.

3d. Of women who are employed to pack the finished goods.

4th. Of workmen employed in transporting the goods.

5th. Of workmen employed in the making and cutting of the glass. Among these are the firemen, the glass-blowers and glass-cutters.

The regulation of the fire requires two firemen for each furnace, who relieve each other in turn, so that there is always one at the furnace. They receive each $1.30 per week, or about 20 cts. per day.

Each glass-pot is tended by one blower, aided by his apprentice, who brings the moulds, removes the finished pieces, &c. The pay of the blowers, as well as that of the cutters, is 9½ cents per *shock* of glass worked. The number of pieces which form a shock, varies according to their nature, and the rate is so arranged, that a good workman may easily gain $1 in 12 or 15 hours work.

Besides this, in the establishments in which the above tariff is established, they are in the habit of giving to the workmen, so long as they are engaged in the works, a wooden cottage to live in, and a kitchen garden of sufficient size for their use, and to permit them to keep a cow, without being subject for these, to any extra labor or manorial dues; so that it is extremely difficult to fix, in a precise manner, the real pay of the workmen, and of course, the cost of the glass.

Of the Expense for Fuel.—I shall give here the annual consumption of fuel in each establishment, supposing it to consist, as is usually the case, of two melting furnaces, the working and repair of which succeed each other, so that there is always one in action.

In the glass works of the Count of Buquoi, where they use dry wood not roasted, they consume annually 1255 cords of wood (160706 cubic feet,) when they are making table glass, or fine glass, as at Silberberg, and 1507 cords (192847 cubic feet,) in making window glass, as at Schwarzthal, the increase arising from the fact that the glass pots there are rather larger, and the time of working being smaller, a greater number of meltings are made per week.

In the establishments of MM. Meyer, at Winterberg and Leonorenhain, where the wood is slightly roasted before employing it to heat the glass furnaces, they consume annually 1130 cords (144812 cubic feet,) in making table glass, and fine glass, which gives an economy of $\frac{1}{10}$ over the consumption at Silberberg. This great economy of fuel is evidently due to the fact, that a certain quantity of heat is necessary to drive out the hygrometric moisture of the wood, and to vaporize it entirely, and that in Silberberg this heat is taken from that developed in the melting furnace, while in the works of MM. Meyer, as in those which we shall hereafter mention, it is taken from the flames which escape from that furnace. At Goldbrünn, Stachau, and Vogelfanghütte, there is consumed 40.2 cub. ft. per day, or 1143 cords per year, (146578 cub. ft.,) a result which accords in a remarkable manner with that obtained from the works of Winterberg and Leonorenhain.

To be Continued.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Mathematico-Physical Class of the Royal Bavarian Academy of Sciences, at Munich.—Translated by Dr. H. Scholl.

A *prize of one hundred ducats* is promised to the successful competitor, for a prize essay on the following subject,—the *Atomic Weights of Sulphur, Iron, and Copper*, are to be stated *in unities of Oxygen*, so that each of these atomic weights be derived exclusively from all the combinations with the other elements mentioned. A sufficiently large number of individual observations is to be made according to every method, in order to obtain a tolerably sure average value, and to find the variation of every experiment from the mean. All the results of weighings are to be reduced according to the method and table of Bessel, to the weight in the vacuum. From all the different series of observations are to be deduced, regard being paid to the relative value of the different methods, the most probable values of the elements mentioned, together with the limits of certainty of their determination according to the method of the least squares. The observations are to be communicated in their original form, so that every number that has an influence upon the result, may be traced back to the original setting down of the experiment.

The reasons that have induced the Academy to the proposition of the foregoing subject, are the following: In calculating chemical analyses by atomic weights, principally in examining organic substances, it happens frequently that the difference between the calculation and the observation is greater than could have been presumed from the accuracy with which the observation had been made. In complicated combinations, by atomic weights, doubts even may remain whether the one numerical ratio, or the other next to it, comes up closer to the observation. This difference arises in part from errors committed in the experiment, in part also from the uncertainty of the determinations of the atomic weights. The uncertainty of the different atomic weights, however, being itself varying, and increasing with their number in the combinations, may have great influence on the result, though the error in the determination of the simple atom be but very slight.

In order to enable us, therefore, to distinguish what share the determination of the atomic weights may have in the difference between the calculation and the observation, and to see whether the analysis is included within this and its own uncertainty, it is requisite not only to have an accurate knowledge of the atomic weights themselves, but to know also how far their determinations may possibly deviate from truth.

The atomic weights have indeed been derived from a great number of observations, part of which had been made with great care, and very considerable improvements in their determination might be obtained, if, from all the observations made, those values were derived by calculation, that approach the nearest to all the experiments; yet the different methods of determination rest on observations of too unequal value to allow us to expect an entirely satisfactory result from the result of this important work.

This it is which has induced the Academy to set a prize on the making of new and most accurate possible determinations, in order to lay thereby the foundation for a thorough and comprehensive establishment of the atomic weights, and of the limits of their certainty. The four elements mentioned have been chosen in preference to others partly on account of their being frequently used, and capable of useful application, partly because two of them enter mutually into different fixed combinations, and may furnish, therefore, different series of equations of condition. The atomic weights forming, moreover, immutable proportions in nature, it needs no farther explanation of the scientific value of their most thorough possible examination.

Competitors for the prize have to send in their essays, written in either German, French, or Latin, and provided with a motto, and a sealed note containing the author's name, before November the 1st, 1845, to the Royal Academy of Sciences, at Munich. The decision as to which of the essays sent in, the prize shall be due to, will be given in the public session of the Academy, March 28th, 1846.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Regulation of Paper Machines.

It is found in practice to be difficult to regulate the motion of the Foudrinier, and other machines, in common use, for the manufacture of endless paper. When the flow of pulp upon any machine is uniform, an acceleration of its motion will make the paper *thin*, whilst a retardation will make it *thick*. Hence it is of the utmost importance, in order to make paper of even weight and thickness, that when the flow of the pulp is uniform, the machine shall move uniformly at the same speed. But if, by any contrivance, the flow of the pulp could be augmented, or checked, just in the same proportion as the machine moves slower, or faster, it is evident that the necessary relation between its speed, and the quantity of pulp thrown on, might be effected and maintained. Consequently, two modes of obtaining the requisite uniformity in the thickness and weight of the endless sheet of paper suggest themselves.

I. To regulate the speed of the motor driving the machine.

II. To regulate the flow of pulp upon the machine.

The attention of constructors has usually been directed chiefly to the first method; and hence we find the machine wheels of paper mills are very frequently *tub-wheels*, wasting a large amount of water, but nevertheless selected and used on account of the regularity of their motion. With this object also it is almost invariably the practice here, to employ an independent wheel to drive the paper machine alone.

Some attempts have recently been made in this country to regulate endless paper machines by the second method, and accordingly *"pulp regulators"* have been applied with considerable success in several important mills.

It being, in fact, a desideratum to procure some unobjectionable means of effecting the regulation referred to, we have translated below, for the benefit of our readers, from J. B. Viollet's "Journal des Usines," *(Journal of the Workshop,)* an account of a mechanical contrivance devised in France for this object. COM. PUB.

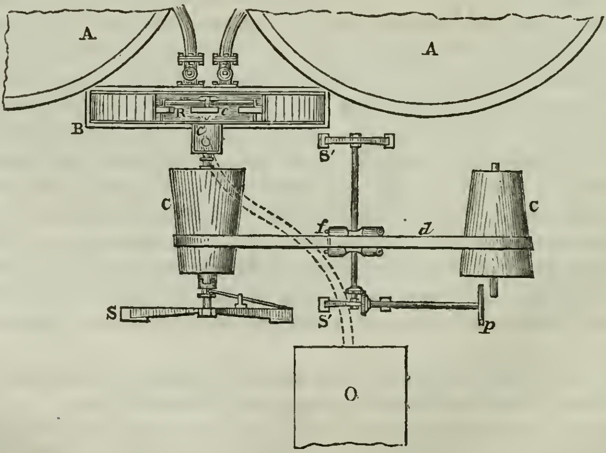
Regulator for feeding machines making Endless Paper: by Messrs. SANDFORD, and VARRALL, *Mechanical Engineers of Paris.**

Whatever care may be taken to render uniform the speed of the motors which drive endless paper machines, and notwithstanding we usually establish for each of these machines a separate water-wheel, constructed of iron, in the best provided works, it has long been impossible to obtain a regularity of motion, and a harmony between the movement of the endless cloth, and the feeding on of the pulp, so that the paper may possess uniformly the same thickness.

From this resulted a serious imperfection, consisting of a marked inequality between the different parts of the long band of paper, and, consequently, between the sheets into which it is cut. We conceived that this inequality was not only a fault, but also that it exposed the manufacturers to disputes not arising from any fault on their part.

In fact, to cause the velocity of the machines, and, consequently, the strength of the paper to vary, it was enough that the resistances op-

Fig. 1.



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* These inventors have taken out (April 18th, 1841,) a French patent for ten years, for this eminently useful apparatus, which they and their successors, Varrall, Middleton & Elwell, have applied, at the present time, to their fine machines for the manufacture of paper.

posed by the materials were not constant, or that the stream of water happened to be disturbed.

It is to avoid these difficulties and inconveniences that Sandford and Varrall have invented the apparatus represented in figures 1, 2, 3, 4, 5, and 6, of which their successors have had the kindness to allow us to take off the details in their workshops.

Fig. 2.

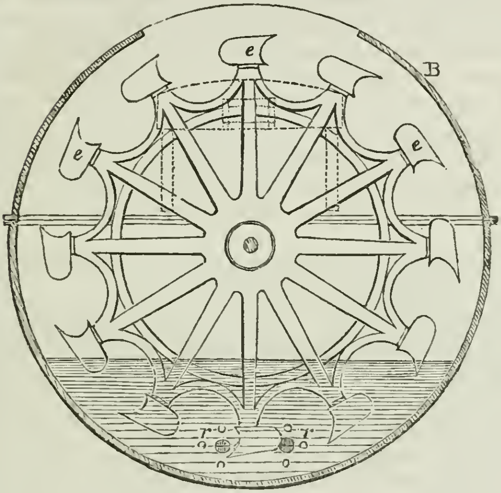


Fig. 4.

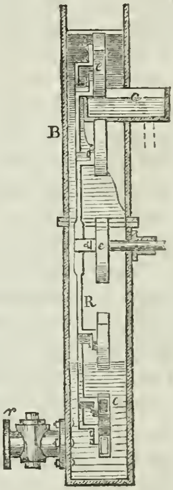


Fig. 3.

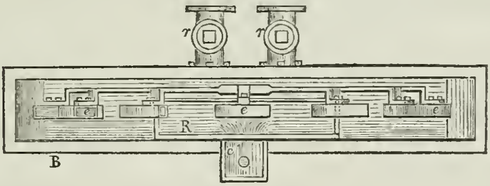


Fig. 5.

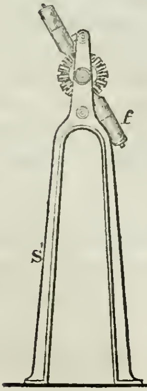
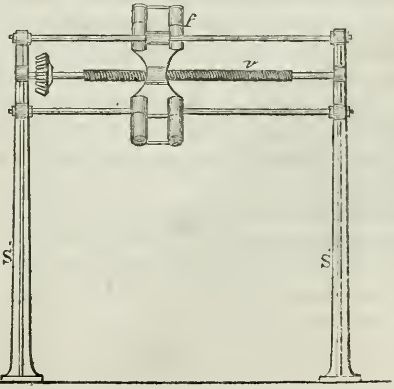


Fig. 6.



This apparatus consists principally of a wheel, R, provided with a certain number of scoops, *e*, which take up the diluted pulp, elevate it, and pour it into a receptacle, from which the filter, *c*, conducts it into the vat for working the paper machine. The motion of the wheel, R, being connected both with that of the water-wheel, and of the endless cloth, it is easy to see that if the receiver accelerates, or retards its motion, in consequence of some variation in the level, or quantity, of the water above, the rapidity of the revolution of the scoop wheel, R, and the motion of the endless cloth of the machine, will each feel a proportional variation. But as the scoop-wheel for each of its revolutions pours the same quantity of pulp into the filter, *c*, of the machine, it is evident that the feeding on of the pulp will augment, or diminish proportionally to the velocity of translation of the endless cloth, and that, consequently, the strength of the paper ought to be constant, so long as we do not change the ratio between the quantity of pulp furnished, and the distance moved in a given time by the metallic cloth.

This principle established, let us make known the details of the ingenious apparatus of Sandford and Varrall.

R, as we have said, is the regulating wheel, provided with scoops, *e, e, e;* this wheel is confined in a drum, B, which the pulp enters from the reservoirs, A, A, by the large stop-cocks, *r, r*, kept entirely open, so as to maintain sensibly in the drum, B, the same level as in the reservoirs, A, A. It is of little importance, moreover, if this level be not rigorously equal, nor even if it varies notably in the reservoirs, A, A; for, provided the pulp arrives in sufficient quantity, and we must take care that it be always so, each of the scoops, every time they issue from the pulp, only withdraws the same quantity of material.*

We easily conceive how advantageous is this property of the apparatus, since, notwithstanding all the variations of level of the liquid pulp in the reservoir, or *stuff chest*, it assures regularity in feeding on the pulp,—a regularity which would often be compromised if made dependent solely on this level.

It is necessary that the relation which exists between the number of revolutions of the scoop-wheel, R, and the velocity of the endless cloth may be varied, when we wish to alter the strength of the paper.

To obtain this effect Sandford and Varrall have controlled the scoop-wheel, R, by the two parallel cones, C, and C′, which carry the belt, *d*. The cone, C′, receiving its motion from the lateral shaft established along side the paper machine, and on which is all the gearing which moves the endless cloth, and the other movable parts of the machine.

It is sufficient to move the belt laterally, (along the cones,) in order to retard, or accelerate the rotation of the scoop-wheel, without altering the angular velocity of the other movable parts, and thus, consequently, to change the relation in question, and of course the thickness of the paper made.

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* The velocity is never so great that the influence of variations in the centrifugal force need be taken into account.

This displacement of the belt, *d*, is effected with great facility, by means of a fork, or shifter, *f*, mounted on a screw, *v*; this screw carried by the standards, S′, S′, is moved through bevel geer by the hand-wheel, *p*, which answers as a handle to manage it. The fork, or shifter, *f*, remains fixed, and, consequently, maintains the belt in the same place always, until we move the hand-wheel, *p*.

This useful apparatus appears to us to be an indispensable adjunct to all paper machines, of which we desire the products to possess with certainty, that uniformity which is so desirable, or rather so necessary.*—*(Journal des Usines.)*

On Coal-Gas. By THOMAS THOMSON, *M. D., F.R.S. L. and E., M.R.I.A., Regius Professor of Chemistry in the University of Glasgow.*

There are four varieties of coal which have been tried in Great Britain in the manufacture of gas, namely, caking coal, cherry coal, splint coal and cannel coal. Of these the cannel coal, or parret coal as it is called here, yields the best gas; the caking coal, or Newcastle coal, yields the worst, and the cherry and splint, though very different in their appearance, yield an intermediate gas, the quality of which, whether from cherry or splint coal, is nearly the same.

There are three varieties of cannel coal in the neighborhood of Glasgow, named from the localities where they occur, Skaterigg, Lesmahagow and Monkland.

The specific gravity of these varieties of coal is as follows:—

Caking coal . .	1·280	Mr. Richardson.
Cherry coal . .	1·268	...
Splint coal . . .	1·307	...
Skaterigg . . .	1·229	Dr. R. D. Thomson.
Lesmahagow .	1·198	...
Monkland . . .	1·189	...

Besides ashes, these six varieties of coal consist of carbon, hydrogen, azote and oxygen, combined in various proportions according to the coal. I shall here give the composition of each; that of the first three was determined by Mr. Richardson of Newcastle in the laboratory at Giessen; that of the last three in the College laboratory by Dr. R. D. Thomson. The azote is small in quantity, so small that Mr. Richardson did not succeed in determining its exact quantity; but we found no difficulty in coming to very exact conclusions by the process of Will and Varrentrapp.† As the quantity in all our varieties tried varied from 1·48 to 1·75 per cent., I have supposed that the azote in the three varieties determined by Mr. Richardson was the mean of these two quantities, or 1·61 per cent. The following table shows the composition of these coals.

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* We cordially agree with M. Viollet, in his commendations of this ingenious and desirable machine, and recommend it to the notice of paper makers in this country. COM. PUB.

† This process was first proposed by Dr. Schafhaeutl, in Phil. Mag. [S. 3. vol. xvi. p. 44.]

	Mr. Richardson.			Dr. R. D. Thomson.		
	Caking coal.	Cherry coal.	Splint coal.	Skaterigg coal.	Lesmahagow coal.	Monkland coal.
Carbon	87·952	83·025	82·924	76·20	76·25	70·02
Hydrogen.	5·239	5·250	5·491	5·44	6·07	5·56
Azote.........	1·610	1·610	1·610	1·75	1·61	1·48
Oxygen......	3·806	8·566	8·847	14·47	12·26	14·86
Ashes	1·393	1·549	1·128	2·14	2·81	8·08
	100·	100·	100·	100·	100·	100·

It will facilitate our conception of the composition of these different coals if we exhibit their condition by empirical formulas representing the atoms of each constituent, the quantity of azote being reckoned one atom: we leave out the ashes, because they have nothing to do with the production of the gas, excepting that they materially influence its quantity.

Caking . . $C_{127} H_{53} Az O_4$
Cherry . . $C_{121} H_{46} Az O_9$
Splint . . . $C_{120} H_{45} Az O_{10}$
Skaterigg . $C_{102} H_{43} Az O_{15}$
Lesmahagow $C_{110} H_{52} Az O_{14}$
Monkland . $C_{111} H_{53} Az O_{18}$

It appears from this table that Newcastle coal contains the most carbon, and Monkland cannel coal the least; while cannel coal contains the most oxygen and Newcastle coal the least; Newcastle coal contains the least hydrogen and cannel coal the most. Now cannel coal yields the best and Newcastle coal the worst gas. This need excite no surprise; carbon not being volatile, it is obvious that if coal contained nothing but carbon it would yield no gas at all. Coal-gas is a mixture of four different gases, most of which are compounds; two are compounds of carbon and hydrogen, one of carbon and oxygen, and the fourth is pure hydrogen. There is no difficulty in conceiving the formation of the gaseous compounds of carbon and hydrogen, but it is not so easy to explain the occurrence of carbonic oxide and hydrogen. These two gases are never entirely wanting; at least I have analyzed above forty specimens of coal-gas from different kinds of coal and from different gas-works without ever failing to find them. I think it probable that they make their appearance towards the end of the process of heating the coal. It is well known that the longer the process of gas making is continued, and the higher the temperature at which the gas is produced, the worse is the gas, and of course the more hydrogen it contains. Is it not possible that coal may contain water; that this water can only be extricated at a high temperature; that its oxygen combines with carbon and forms carbonic oxide, while the hydrogen makes its escape in the gaseous state? If this supposition were true, there ought to be a constant ratio between the volume of carbonic oxide and hydrogen in the coal-gas; but this not being the case, it is obvious that the supposition cannot be well founded*.

A ton of Lesmahagow coal, when distilled at the usual temperature, yields about (10,080 cubic feet) one-fifth of its weight of gas, two-fifths of coke, and two-fifths of tar, water, &c.

The gas contains about one-fifth of the carbon in the raw coal, two-elevenths of the hydrogen, and two-ninths of the oxygen; about one-half of the carbon remains in the state of coke, so that about two-fifths go to the formation of the naphthalin, naphtha, naphthene, naphthol, &c., which are formed during the distillation.

Nine-elevenths of the hydrogen and seven-ninths of the oxygen go to the formation of water and various other compounds. The ammonia formed amounts to about 1 per cent. of the liquor obtained during the distillation of the coal.

When gas-works were first established the coal was distilled in iron retorts, but it has been found more economical to substitute vessels of stoneware, or rather indeed ovens of fire-brick made air-tight; these I believe are generally superseding the iron retorts.

During the course of last winter I made thirty-five analyses of gas from different gas-works, but most commonly Glasgow gas. The gas which I used was taken from a pipe at some distance from the gas-works, because the gas required to be washed and purified before it was examined. After turning the stop-cock the gas was kindled and allowed to burn for several minutes before I began to collect it. In every case it contained a mixture of common air, which varied in different specimens of gas from ·4 per cent. to 28 per cent.; the mean quantity was 12½ per cent. The specimen containing 28 per cent. of common air was brought up from Greenock, and though very great care was taken in packing it, it is possible that at least a portion of this air might have made its way into the bottles during the transit. If we omit this specimen, the average quantity of common air in the Greenock gas was 10½ per cent.; the average quantity in the Glasgow gas was 12⅓ per cent.

I think it most likely that the common air, which forms a constant ingredient in all gas from gas-works that I have examined, had made its way into the pipes, which it must be very difficult to make air-tight; and when the pressure is removed common air will undoubtedly enter wherever it can find access. The Greenock gas was collected in an apartment very near the gas-works; the Glasgow gas was collected in my laboratory, which may be about a furlong from the gas-works; now the average quantity in the Greenock gas was $10\frac{1}{2}$, and in the Glasgow $12\frac{1}{3}$.

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* Mr. John Hart, of this city, states that he made an experiment which appears to explain the appearance of the hydrogen towards the end of the process. "Having conceived the idea many years ago of causing gas to take up an additional dose of carbon, by passing it over red-hot charcoal, he procured a 1⅓ inch iron pipe, and having charged it with charcoal, he passed it through the furnace below the gas retort, and joined one end with the pipe from the retort and the other to the pipe leading to the condenser; the fire was then applied and the retort charged as usual. After the gas-holder had risen about a foot, he observed the lead pipe leading to the condenser becoming very hot; it soon after gave way and fell to pieces, and the whole of the gas escaped into the air; but it had no longer the yellow silky appearance of gas issuing from a retort; it had become a white vapor, and had also lost the smell. When the charcoal was examined it was found to be covered over with a fine smooth, shining black coat of carbon, which had been deposited on it." Mr. Hart has concluded from this and other facts, that the gas is decomposed by the red-hot coke, and proposes that the coal should be applied in thin layers to the interior surface of the retorts.

The highest specific gravity of the Glasgow gas was 0·582, and the lowest 0·462; the average was 0·503.

The quantity of olefiant gas in Glasgow gas varied from 11·77 per cent. to 17·83 per cent.; the mean quantity was 13·52 per cent.

I got gas made at Greenock with as much care as possible from each of the three varieties of cannel coal found in the neighborhood of Glasgow, namely, Skaterigg, Lesmahagow and Monkland: the specific gravities of these gases were,

Skaterigg	0·497
Lesmahagow	0·560
Monkland	0·622

The olefiant gas per cent. contained in each was as follows:—

Glasgow	13·52
Skaterigg	14·15
Lesmahagow	16·66
Monkland	22·15

Mr. Ritchie, the manager of the Greenock gas works, who prepared these gases, told me that he thought rather too much heat had been applied to the Lesmahagow coal, which, in his opinion, would have somewhat deteriorated the Lesmahagow coal gas.

The mean quantity of carburetted hydrogen gas in the Glasgow coal gas was 60.6 per cent.; the smallest quantity was 47.33, and the largest 79.77; the quantity of this gas in the gases from cannel coal was as follows:—

Skaterigg,	66.49
Lesmahagow,	59.94
Monkland,	48.77

The goodness of these gases is in the order of naming them. It would appear from this, that the smaller the proportion of carburetted hydrogen the better is the gas; the reason is that the olefiant gas increases as the carburretted hydrogen diminishes.

The average quantity of carbonic oxide in Glasgow gas was 12 per cent., the smallest quantity was 6.34 per cent., and the greatest quantity 15 per cent.: the quantity of this gas in the three gases from cannel coal was as follows:—

Skaterigg,	7.07
Lesmahagow,	12.00
Monkland,	11.76

The mean quantity of hydrogen gas in Glasgow gas was 12.44 per cent., the greatest quantity was 22.85 per cent., and the smallest quantity 2.21 per cent.: the quantity in the three gases from cannel coal was as follows:—

Skaterigg,	12.29

Lesmahagow,	11.46
Monkland, .	17.32

The common method of determining the light emitted by gas during its combustion, is to set fire to a jet of a given height, and issuing from an orifice of a given diameter, and to compare it with the light given out by a wax candle of six in the pound, usually denominated short sixes; an opake body is placed on a sheet of paper, horizontally between the two flames, and it is so placed that the two shadows formed by it are of equal intensity. The distance between this opake body and the flames is measured, and the light emitted by each is as the square of that distance; thus, if the distance between the gas flame and the opake body be two feet, while its distance from the flame of the candle is only one foot, then the light given out by the gas is four times as great as that of the candle.

The light given by the combustion of a jet of Glasgow gas, issuing from an orifice of 1-30th of an inch in diameter, and four inches in height, was as follows:—

1. On the north side of the river = 2.68 candles.
2. On the south side of the river = 1.77 "

This method of measuring the quantity of light appears, at first sight, very simple, but I found on trial that it was attended with so many sources of error, that I was afraid to depend upon it; fortunately there is another method of much easier execution, which I found much more satisfactory.

The quantity of light given out during the combustion of coal gas is very nearly proportional to its specific gravity; the heavier a gas is the slower does it issue from an orifice of a given diameter, when propelled by a given force. I measured the time which a cubic foot of each gas took to issue from an orifice of 1-30th of an inch, when propelled by a force such as to form a jet of flame, when lighted, of four inches in length, and I considered the goodness of the gas as proportional to this time: the result was as follows:—

1. Glasgow gas, north,	70′	18″
2. " south,	60	9
3. Skaterigg, . .	84	10
4. Lesmahagow, . .	101	10
5. Monkland, . .	101	

Certainly, in a commercial point of view, the value of the gas (the price per cubic foot being the same in all,) is exactly proportional to the time that it takes to burn, because the consumption in a given time depends upon that time.

If, therefore, a thousand cubic feet of gas be charged 8*s*. on both sides of the river, it is clear that the consumers on the south side pay at the rate of 9*s*. 4*d*. per cubic foot, because they consume 7000 cubic feet in the same time that those on the north side consume 6000.

If Glasgow gas, Skaterigg gas, and Lesmahagow gas are each charged at 8*s*. per 1000 cubic feet, the price paid by the consumers will be—

	s.	*d*.
1000 feet of Lesmahagow gas, . .	8	0

	s.	*d.*
1000 feet of Skaterigg gas, . .	9	4¼
" Glasgow gas, . . .	11	6½
" " south side river,	13	5¾

Lond., Edin., and Dub. Philos. Mag.

Summary of Experiments made with Screw Propeller and Rotary Engines fitted to Mr. Beale's trial boat, the "Pigmy Giant."

By E. W. Baker, *late Engineer of the Prince of Wales.*

The "Pigmy Giant" was built of iron by Messrs. Ditchburn and Mare, of Blackwall; she is 38 feet long, and of 8 feet 6 inches beam; 4 feet deep; her draught of water at midship 2 feet; midship section immersed = 9 square feet; she drops at the stern when going well about 12 inches, and is built to draw one foot more at the stern than at the head. The boat was originally intended for government service, and is built from the lines of a man-of-war's pinnace. The engines and boilers used in the experiments, afterwards detailed, are the same as those described in No. 1056, of this journal. The furnace is urged by a fan. The calculations of the power of the engine contained in the table, a vacuum has been added equal to a column of mercury of 20 inches, and the speed of the vessel through the water is the mean of various experiments. The weight of the valve and lever, together with Salter's spring balance, (which will amply allow for friction and steam cooling in pipes, &c.,) are not taken into account. In the column showing the cubic feet of water pumped into the boiler, the contents of the plunger are taken as being equal to 11.6 cubic inches, and one-third is deducted from the gross amount for leakage, &c.

From the following table it will be perceived that this little vessel requires an extraordinary degree of pressure to acquire any thing like velocity, and although no correct account of her consumption of fuel has been kept, I can state from personal observation, that when exceeding a speed of 9½, her consumption of *best oven coke* is nearly one cwt. per hour.

The propeller with which the experiments were made, was constructed by Mr. Joshua Taylor Beale, in imitation of Blaxland's, and is thus described by him in a paper originally intended for insertion in this journal; "Propeller is composed of four arms, and 4 segments of a screw, forming part of a four-threaded screw; its diameter 2 feet 1½ inches, and 4 feet pitch; segments equal half radius surface of each ONE-FIFTH OF THREE QUARTERS of a disk the diameter of the propeller; the arms may be round, or square; the propelling surface = two-ninths of midship section of boat; midship section of boat = 9 square feet."

Mr. J. B. Beale has discovered that *one-fifth of three quarters*, or in other words, *three-twentieths*, of a disk containing 510.7 square inches, will only contain 288, (this being the number of square inches in two-ninths of 9 square feet,) instead of 306, the number usually assigned to it by other mathematicians. I must confess I do not understand this; perhaps Mr. Beale will explain.

Experiments with the "Pigmy Giant."

Pressure in pounds on the square inch in engine.	Strokes of the pump per minute.	Water pumped in the boiler in cubic feet per hour.	Number of revolutions of the engine.	Speed of the piston in feet per minute.	Calculated horse power.	Number of revolutions of the propeller.	Calculated speed of the propellers.	Speed of the boat through water in miles per hour.	Slip in miles per hour.
12	22	5.92	68.75	251.8	2.39	90.15	4.09	3.82	.27
14	26	7.0	81.25	297.78	3.08	106.65	4.84	4.51	.33
16	30	8.08	93.75	343.59	3.85	123.05	5.59	5.22	.37
18	34	9.16	106.25	389.40	4.70	139.45	6.33	5.91	.42
20	37	9.96	115.62	423.74	5.51	151.85	6.90	6.42	.48
22	38	10.24	118.75	435.21	6.01	155.85	7.08	6.54	.54
24	40	10.78	125.	458.12	6.72	164.05	7.45	6.85	.60
26	42	11.32	131.25	481.03	7.47	172.25	7.82	7.18	.64
28	44	11.86	137.50	503.93	8.26	180.45	8.20	7.54	.66
30	45	12.12	140.62	514.62	8.88	184.55	8.38	7.69	.69
32	47	12.66	146.87	537.52	9.74	192.75	8.76	8.2	.74
34	48	12.94	150.	548.91	10.42	196.85	8.94	8.31	.81
36	50	13.46	156.25	572.65	11.37	205.05	9.32	8.42	.90
38	52	14.02	162.50	595.56	12.34	213.25	9.69	8.70	.99
40	53	14.28	165.62	606.99	13.10	217.35	9.87	8.84	1.03
42	55	14.82	171.87	629.90	14.14	225.55	10.25	9.14	1.11
44	56	15.10	175.	641.37	14.92	229.65	10.43	9.22	1.20
46	57	15.36	178.12	652.80	15.78	233.75	10.62	9.28	1.34
48	58	15.64	181.25	664.28	16.63	237.85	10.81	9.44	1.37
50	59	15.90	184.37	675.71	17.50	241.95	10.94	9.52	1.42
52	60	16.18	187.50	687.18	18.39	246.05	11.18	9.54	1.74
54	61	16.44	190.62	698.62	19.33	250.15	11.37	9.62	1.75
56	62	16.70	193.75	710.09	20.23	254.25	11.55	9.74	1.81
58	64	17.24	200.	733.	21.52	262.45	11.92	9.81	2.11
60	65	17.52	203.12	744.43	22.5	266.55	12.36	9.96	2.40

The table, though not so perfect as could be wished, will enable the reader to form an opinion of this class of rotary engines, as it gives the *rotary* horse power requisite to propel 9 square feet of surface at a certain velocity. By comparing the results in this table with others obtained by the ordinary reciprocating engine, we shall have data to estimate which class of engine gives out the greatest effect.

It may not be out of place to add, that with a propeller constructed by Mr. Blaxland for trial in this boat, a speed of 10.5 was realized, which was the greatest ever attained by the *Pigmy Giant.* The same propeller divested of two of its blades, and containing less propelling surface than *half* of "*one-fifth of three-quarters* of a disk the diameter of the propeller," attained a speed of upwards of 10 miles per hour. A propeller of the same diameter, and with flat plates, when tried in this vessel, once reached a velocity of 6 miles per hour.

Lond. Mechanics' Mag.

Extraordinary Hydraulic Performance at Woolwich Dock-Yard.

A most interesting exhibition of hydraulic prowess recently took place in her majesty's dock-yard at Woolwich, where there is a floating caisson of large dimensions, from which it is occasionally necessary to remove the water. This has hitherto been accomplished by means of a pair of ten-inch pumps, fitted up in the best possible manner by an eminent engineering firm in London. These pumps have been worked by a party of thirty-two convicts, in two gangs of sixteen each, relieving each other at intervals of ten minutes, by which means the water has been pumped out in three hours and a half, the men at the end of that time being much distressed by their continued exertions. Mr. Walker (of Crooked-lane, King William street,) having offered to raise the required quantity of water *in half the time*, with *half the number of hands*, by means of his newly invented pump of which we gave an account in volume xl, page 307*, his proposal was made known to the Board of Admiralty, who immediately called upon Mr. Walker to fulfil his promise. Mr. Walker accordingly fitted up a pair of twelve-inch pumps worked by a rotary motion, which were completed and tried on the 20th of September last, under the superintendence of Captain Dennison, R.E., in the presence of Lord Adolphus Fitzclarence, Sir Francis Collier, Mr. Oliver Lang, and the principal authorities of the dock-yard, who seemed to take a lively interest in the experiment, as the speedy emptying of the caisson is to them a matter of great moment. The new pumps were manned by fourteen convicts (the same formerly employed in this work,) in two gangs of seven each, relieving each other at intervals of fifteen minutes. *In one hour and fourteen minutes* the required task was accomplished, the men being in no way fatigued! The quantity of water raised was about 3350 cubic feet, or 95 tons, lifted 13 feet high! The result of this trial created great astonishment among all present; Mr. Walker was warmly congratulated on having more than fulfilled his promise, and a full report of the trial was duly made to the Board.

By placing a second pair of Mr. Walker's improved pumps in the caisson, it may, in case of emergency, be emptied in half an hour by 28 hands, although with the former pumps 32 men could not accomplish that task in less than three hours and a half. It is always very desirable to have the power of quickly emptying the caisson, but under certain circumstances, in the event of fire, for instance, it is of the utmost importance to be able to do so.

Ibid.

Barometer Pump.

Colonel Everest also described an instrument called a barometer pump, for filling barometer tubes *in vacuo*. This was a single acting air-pump, so arranged as to exhaust the air from the tube to be filled, while a capillary tube, dipping into a reservoir of mercury, and curved at the end next the tube, dropped the mercury into the tube as it rose above the bend, (after the exhaustion had been carried as far as possible,) by dipping a glass rod into the reservoir. The mercury as it comes into the tube is heated to a temperature sufficient to boil it, and it is desiccated by a bottle of strong sulphuric acid, which is made to communicate with the canal into which the tube to be filled, and the capillary filling tube are luted. Colonel Everest mentioned that the best material for the valves of an air-pump was the swimming bladder of a fish.—*(Proc. Brit. Assoc.)*

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* See Journal of the Franklin Institute vol. iv, 3rd series, page 109.

Lond. Athenæum.

Report on a Hydrogen Furnace for Vitrification, and other applications of Heat in the Laboratory. By the Rev. W. V. HARCOURT.

At the request of the British Association Mr. Harcourt had undertaken, some years since, to make experiments on vitrification. Dr. Faraday, in his experiments on glass, had the greatest difficulty in procuring perfectly homogeneous masses, arising, in most cases, from the almost impossibility of procuring a regulated heat in the ordinary furnaces. Mr. Harcourt, impressed with the advantages which might be gained for optical purposes, by procuring glasses formed by other salts and bases, instituted some experiments with a view of ascertaining this point. It was considered, that if a tribasic phosphate formed ed a glass, and the bibasic phosphate formed a glass, we should have, in all probability, glasses having different optical properties. Finding difficulty in proceeding with these experiments, at the heat given by ordinary furnaces, and the risk to which the platina crucibles were exposed, he was induced to try the effects of hydrogen burning in common air. Dr. Dalton was consulted on the construction of the first hydrogen furnaces, and he suggested the difficulty which was found to arise in practice—that hydrogen gas burning, through small orifices, with great pressure, would blow itself out. This difficulty was, however, overcome in the management of the apparatus brought before the Section. This apparatus consisted of an iron tube, in which the gas was generated by the addition of 15 ounces of zinc to three-quarters of a pint of oil of vitriol, and ten pints and a half of water. The gas produced was found to be in ten minutes under a pressure of 21 atmospheres, in sixteen minutes and a half under a pressure of 25 atmospheres, and in eighteen minutes under a pressure of 26 atmospheres. The gas was conducted into another cylinder, and from thence to the jets, over which was suspended a platina crucible. The gas being ignited at these jets, maintained, with the above charge, the platina crucible at a white heat for twenty minutes. Gems had been fused by the heat thus generated. Several kinds of jets were used, as it might be necessary to surround the crucible with heat, or only to apply the heat to the bottom of it. Experiments with this apparatus have been made upon the phosphates of antimony, zinc, barytes, and cadmium : the results have not been, however, quite satisfactory. In some the striæ interfered with the transparency of the glass formed; and in the case of the monobasic phosphate of zinc, it was found that, to whatever heat the compound may have been exposed, the glass, thus formed, was deliquescent. The reading of this report was accompanied by some experiments with the hydrogen furnace in question, for the purpose of showing the intense heat which could be produced.

Dr. Faraday bore testimony to the advantages of this arrangement. He had found in all his experiments on glass, in which the elements were chemically combined, that crystalization took place. He regarded all common glass as examples of solution, rather than of chemical combination. Borate of lead, and sillicate of lead, if fused in small quantities, so that they cooled quickly, were transparent, but if fused in masses, which required a longer time, they were in a crystalline condition.—Mr. Harcourt remarked, that in the monobasic phosphate of zinc, which was transparent when vitrified, the quantity of acid was probably exceedingly small, but this glass was striated.—Dr. Faraday said, that some of the purest specimens of American ice show similar striæ, although it was in a state of exceeding purity, yielding the purest of all water when liquified.—Some remarks were then made by Mr. Pearsall, on the action of hydrogen on platina. An experiment was named by Mr. Harcourt, in which a platina tube was destroyed by an attempt to fuse ultra-marine in it.—Prof. Liebig stated, that platina was soon fused if exposed to a charcoal fire, from the action of the silicon contained in the charcoal.—*(Ib.)*

Ibid.

Contributions to Actino-Chemistry.—On the Amphitype, a new Photographic Process. By Sir J. HERSCHELL.

At the end of my paper "On the Action of the Solar Spectrum on Vegetable Colors," communicated to the Royal Society, in 1842, a process is alluded to (in Art. 230,) by which positive pictures are obtained, having a perfect resemblance to impressions of engravings taken with common printers' ink. I had hoped speedily to have perfected this process so far as to have reduced it to a definite statement of manipulations, which would insure success. But, capricious as photographic processes notoriously are, this has proved so beyond even the ordinary measure of such caprice; and, having of late been able to give little or no time to this pursuit, I have thought it preferable to describe the process in a general way, and in a form in which I have found it frequently, and sometimes eminently successful; not so much for the sake of its results, which yet are not wanting in interest, or beauty, as for the curious and very complicated photographic habitudes of iron, mercury, and lead, which are concerned in their production,—rather, in short, as a contribution to the newly created science of *actino-chemistry*, than to the photographic art. Paper proper for producing an amphitype picture may be prepared either with the ferro-tartrate, or the ferro-citrate, of the protoxide, or the peroxide, of mercury, or of the protoxide of lead, by using creams of these salts, or by successive applications of the nitrates of the respective oxides, singly, or in mixture, to the paper, alternating with solutions of the ammonio-tartrate, or ammonio-citrate, of iron,* the latter solutions being last applied, and in more or less excess. I purposely avoid stating proportions, as I have not yet been able to fix upon any which certainly succeed. Paper so prepared and dried takes a negative picture, in a time varying from half an hour to five or six hours, according to the intensity of the light; and the impression produced varies in apparent force from a faint and hardly perceptible picture, to one of the highest conceivable fullness and richness both of tint and detail, the color in this case being a superb velvety brown. This extreme richness of effect is not produced except lead be present, either in the ingredients used, or *in the paper itself.* It is not, as I originally supposed, due to the presence of free tartaric acid. The pictures in this state are not permanent. They fade in the dark, though with very different degrees of rapidity, some (especially if free tartaric, or citric, acid be present,) in a few days, while others remain for weeks unimpaired, and require whole years for their total obliteration; but though entirely faded out in appearance, the picture is only rendered dormant, and may be restored, changing its character from negative to positive, and its color from brown to black, (in the shadows,) by the following process:—

A bath being prepared by pouring a small quantity of solution of pernitrate of mercury into a large quantity of water, and letting the sub-nitrated precipitate subside, the picture must be immersed in it, (carefully and repeatedly clearing off all air bubbles,) and allowed to remain till the picture, (if anywhere visible,) is entirely destroyed, or if faded, till it is judged sufficient from previous experience; a term which is often marked by the appearance of a feeble positive picture, of a bright yellow hue, on the pale yellow ground of the paper. A long time (several weeks) is often required for this, but heat accelerates the action, and it is often complete in a few hours. In this state the picture is to be very thoroughly rinsed and soaked in pure warm water, and then dried. It is then to be well ironed with a smooth iron, heated so as barely not to injure the paper, placing it, for better security against scorching, between smooth clean papers. If then the process have been successful, a perfectly black, positive picture is at once developed. At first it most commonly happens that the whole picture is sooty, or dingy, to such a degree that it is condemned as spoiled, but on keeping it between the leaves of a book, especially in a moist atmosphere, by extremely slow degrees this dinginess disappears, and the picture disengages itself with continually increasing sharpness and clearness, and acquires the exact effect of a copper plate engraving on a paper more or less tinted with pale yellow. I ought to observe, that the best and most uniform specimens which I have procured have been on paper previously washed with certain preparations of uric acid, which is a very remarkable and powerful photographic element. The intensity of the original negative picture is no criterion of what may be expected in the positive. It is from the production, by one and the same action of the light, of either a positive, or a negative, picture, according to the subsequent manipulations, that I have designated the process, thus generally sketched out, by the term *amphitype*,—a name suggested by Mr. Talbot, to whom I communicated this singular result; and to this process, or class of processes, (which I cannot doubt when pursued will lead to some very beautiful results,) I propose to restrict the name in question, though it applies even more appropriately to the following exceedingly curious and remarkable one, in which silver is concerned. At the last meeting I announced a mode of producing, by means of a solution of silver, in conjunction with ferro-tartaric acid, a dormant picture brought out into a forcible negative impression by the breath, or moist air. The solution then described, and which had, at that time, been prepared some weeks, I may here incidentally remark, has retained its limpidity and photographic properties quite unimpaired during the whole year since elapsed, and is now as sensitive as ever, —a property of no small value. Now, when a picture (for example, an impression from an engraving,) is taken on paper washed with this solution, it shows no sign of a picture on its back, whether that on its face be developed, or not; but if, while the actinic influence is still fresh upon the face, (*i. e.* as soon as it is removed from the light,) *the back* be exposed for a very few seconds to the sunshine, and then removed to a gloomy place, a *positive picture, the exact complement of the negative one on the other side*, though wanting, of course, in sharpness if the paper be thick, *slowly and gradually makes its appearance* there, and in half an hour, or an hour, acquires a considerable intensity. I ought to mention that the "ferro-tartaric acid" in question, is prepared by precipitating the ferro-tartrate of ammonia (ammonia-tartrate of iron,) by acetate of lead, and decomposing the precipitate by dilute sulphuric acid.

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* So commonly called, and sold as such, but as I am disposed to regard their composition, their chemical names would be ferro-tartrate and ferro-citrate of ammonia.

P. S.—When lead is used in the preparation of amphitype paper, the parts on which the light has acted are found to be in a very high degree *rendered water-pooof.—(Ib.)*

Ibid.

Workshop Micrometer.

Mr. Whitworth then exhibited an instrument for measuring bodies to a very minute degree of accuracy. It consisted of a strong frame of cast-iron, at the opposite extremities of which were two highly finished steel cylinders, which traversed longitudinally by the action of screws one-twentieth of an inch in the thread; these screws were worked by two wheels, placed at opposite extremities of the frame, the larger of which had its circumference divided into five hundred equal parts; the ends of the cylinders, at the places were they approached each other, were reduced to about a quarter of an inch, and their hemispherical ends were highly polished. To measure with this instrument, the large circle was brought to its zero, and the body to be measured being placed between the cylinders, the small circle was turned until the two cylinders touched the opposite sides of the body, which being removed, and the large circle turned until the ends of the two cylinders were brought to touch the turns and parts of a turn required for this, gave the breadth of the body which had been interposed to the ten-thousandth part of an inch, and since the one-tenth of one of the divisions could be readily estimated, the size of the body could be thus estimated easily to the one-hundredth-thousandth part of an inch. Mr. Whitworth stated, that in the accuracy required in modern workshops, in fitting the parts of tools and machines, the two-foot rule heretofore in use is not, by any means, accurate enough; his object was to furnish ordinary mechanics with an instrument which, while it afforded very accurate indications, was yet not very liable to be deranged by the rough handling of the workshop; and he conceived this instrument secured those advantages. It surprised himself to find how very minute a portion of space could be by it, as it were, felt. By it the difference of the diameters of two hairs could be rendered quite palpable.—*(Ib.)* Ibid.

Description of an Air-Duct to be used in Glass Furnaces, for the Prevention of Smoke. By Z. M. GREENHOW.

Smoke, it is assumed, must be prevented by the supply, under proper conditions, of additional quantities of oxygen gas. Though this intention has been successfully carried out in steam engine and other furnaces, no attempt has been successful to prevent the annoyance occasioned by glass furnaces. One of Mr. Greenhow's models represented the reverberatory furnace used in the manufacture of crown glass. In this kind of furnace the smoke and products of combustion escape through the openings in the sides, which give the workmen access to the pots of glass, and are unprovided with flues. To provide the necessary supply of fresh air, Mr. Greenhow proposes a perpendicular air duct (made of the same refractory clay of which the glass pots are constructed,) rising through the middle of the fire, and supported by the stone arch on which the bars rest. This air-duct rises to the height of five feet within the furnace, is one foot in diameter, and distributes, through numerous apertures, any quantity of air that may be required for the completion of the combustion of the fuel; and from its situation in the centre of the furnace, it must soon acquire and communicate a high degree of temperature to the air it transmits. Mr. Greenhow showed a second model of a steam engine furnace with a horizontal air-duct placed anterior to the bridge which it crowns and overlaps. At this situation heated air is distributed through small apertures, so as to mingle with the burning gases, and insure their more complete combustion.—*(Ib.)*

Ibid.

On the Alteration that takes place in Iron by being exposed to long continued Vibration. By Mr. W. LUCAS.

At Cork, this subject was again brought forward, and certain specimens of iron exhibited, in order to show the effects produced upon the iron by being exposed to a certain degree of concussion, or vibration, during the process of swaging, and again restored to its original state by being annealed, in accordance with the results detailed by Mr. Nasmyth, at Manchester, in 1842; in addition to these, also were exhibited specimens of portions of the same iron that had been exposed to the concussion of a large tilt hammer, working at the rate of about 350 strokes per minute, which occasioned the bars of iron to break short off at the point of bearing in the course of twenty-four hours; there was also shown a portion of one of the hammer shafts, the texture of which had evidently been altered, probably by the long continued and repeated concussions to which it had been exposed, for instead of breaking with the peculiar splintery fracture common to wood, it broke with a peculiar short fracture, and this, I am informed, is a common occurrence. In continuance of these experiments upon the effects of concussion, or vibration, Mr. Lucas laid before the Section the results of some further experiments.—*(Ib.)*

Ibid.

Iron Steamboats.

"The Wonder," an iron steamboat built by Messrs. Ditchburn and Mair, the successful builders of iron vessels, for running between Southampton and Havre, made a trial trip down the river Thames on the 27th of September last; her length is 160 feet, breadth of beam 22 feet, depth of hold 12 feet 9 inches, draught when light 5 feet 6 inches, when loaded 6 feet 6 inches. She is fitted with three engines on the atmospheric principle, by Messrs. Seaward and Capel, of the Canal Iron Works. Blackwall; each engine has an open topped cylinder 53 inches diameter, with a 3 feet 6 inches stroke, they work on the direct action principle; the lower end of the piston rods move on a joint attached to the top of the piston, and the other end is connected to the crank of the paddle-wheel shaft, the 3 cranks being placed at different angles, so that when one piston is at the top of the cylinder, another is at the bottom, and the third about the middle; the three cylinders exhaust their steam into one condenser, with one air-pump. The engines during the trial made 38 and 39 strokes per minute, the paddle-wheels are 19 feet diameter to the extremity of the float boards, and are on the self-feathering principle, being a modification of Morgan's paddle-wheel; the nominal power of the three engines, at a velocity of 220 feet per minute, is equal to 150 horses, but the real effective power is nearer double, as proved by the great velocity of the vessel. She ran the mile distance in 4 minutes 17 seconds against tide, being a velocity equal to 14 miles per hour, the tide running at the time about 2½ miles per hour. The boiler is of the tubular principle, with five furnaces, and is only 7 feet 6 inches long; it is furnished with a brine apparatus for constantly drawing off a certain quantity of water, this water is pressed by the force of the steam through a pipe dipping down to near the bottom of the boiler, and coming out in the front near the top, where it is furnished with a cock to regulate the emission of the water, this pipe passes along the front of the boiler, then along side of the engine room to a cistern in which the water runs, and is allowed to overflow to the outside of the vessel. The water for supplying the boiler is taken from the hot well, and forced by the feed pump through a pipe which passes backwards and forwards two or three times in the brine cistern just described, and thence into the boiler; by this process the boilers are supplied with water nearly at a boiling temperature. There are several other ingenious contrivances adopted by Messrs. Seaward and Capel for working the valves, &c. Civ. Eng. & Arc. Journ.

Her Majesty's Steamship Rattler with Smith's Screw Propeller.

This fine steam frigate, after having made a great variety of experiments with the different propellers that have been projected by Mr. Smith, Mr. Woodcroft, Mr. Blaxland, Mr. Steinman, Mr. Sunderland, and other persons, in order to ascertain their comparative merits, lately made her final trial in the river. The screw that has been found to produce the highest rate of speed with the smallest consumption of power, is that of Mr. F. T. Smith, known as the inventor and adapter of the Archimedean screw. The Admiralty have in consequence determined to send the Rattler to sea, fitted with a propeller in accordance with the suggestions of that gentleman. The last trial was made partly with the view of ascertaining the precise rate of the ship in steaming in smooth water with Mr. F. T. Smith's propeller, and partly to determine its effect as compared with what had been done with other propellers that have been recommended to the notice of the Admiralty. On this occasion the average of twelve trials at the measured distance in Long-reach showed a speed of 9.9 knots, or 11½ statute miles, an hour, which rate of speed, considered in comparison with the small amount of power, viz., 200 h. p., the amount of power of the engine of the Rattler, in relation with her tonnage, 888 tons, ranks her performance higher in the history of steam navigation than the performance of any vessel of her class, either in the service of her majesty, or in the commercial steam navy of the empire. It should be mentioned that the Rattler was built in every respect as a sister ship to her majesty's steam ship the Prometheus, with this difference, that the Prometheus has paddle-wheels. The Prometheus, on her trial at the measured distance, reached only to the rate of 8¾ knots an hour. The Rattler has already got her masts on board; she is rigged with a foremast like a frigate, or sloop, her middle and mizen masts are rigged as schooner masts, her gun carriages are also on board, and she is ordered to be equipped for sea as speedily as possible; and in consequence of the complete success which has attended the application of the screws to her, several others, we believe six, iron ships of a large class are forthwith to be constructed on the same principle. The trials were made under the superintendence of Mr. Lloyd, chief engineer of Woolwich dockyard, and Captain Smith, R. N., of the royal dockyard.

London Times.

On Crystals in the Cavities of Topaz, which are dissolved by heat, and re-crystalized on Cooling. *By* Sir DAVID BREWSTER.

Sir David gave a brief notice of the discovery which he had made, about twenty years ago, of two new fluids in the crystalized cavities of *topaz*, and other minerals. One of these fluids is very volatile, and so expansible, that it expands twenty times as much as water with the same increase of temperature. When the vacuities in the cavity which it occupies are large, it passes into vapor, and in these different states he had succeeded in determining its refractive power, by measuring the angles at five feet. Total reflection takes place at the common surface of the fluid of the topaz. The other fluid is of a denser kind, and occupies the angles and narrow necks of cavities. The cavities, however, in which the soluble crystals were contained, are of a different kind. They (viz. the cavities,) were imperfectly crystalized, and thus they exist in specimens of topaz which contain the cavities with the two new fluids; they contain none of the volatile and expansible fluid, which is doubtless a condensed gas. The crystals which occupy them are flat, and finely crystalized rhomboids. When heat is applied, they become rounded at their angles and edges, and soon disappear. After the topaz has cooled, they again appear, at first like a speck, and then recrystalize gradually, sometimes in their original place, but often in other parts of the cavity, their place being determined by the mode in which the cooling is applied. We understand that Prof. Liebig, who regards these fluids and crystals as peculiarly interesting, has made arrangements to investigate their nature, when taken out of their cavities by Sir David Brewster,—an operation of extreme difficulty, owing to the small size of the cavities which contain them, and the rapid disappearance of the volatile fluid, which rises into a drop, and contracts into a flat disk, as if it were endued with vitality, finally vanishing and leaving a sediment behind it, which, when breathed upon, again becomes fluid.—*Pro. Brit. Ass.*

Lond. Athenæum.

Heath's Cast-Steel.

Before the introduction of Mr. Heath's process, which consists in adding carburet of manganese to the melting pot, all steel which was to be worked into a fine edge was made of iron procured from one mine only, that of Dannemora, in Sweden. It was consigned to a house at Hull, at a cost of 38*l.* per ton, in quantities not exceeding 1100 tons per annum, and marked L in a hoop. The price limited its use; but by means of this patent the inferior sorts of iron, as those at 15*l.* per ton, may be made available. Steel is made by it which has all the beauty of cast-steel, and all the welding advantages of shear steel. In the manufacture of table knives its advantages have been manifest. Formerly these articles were made by tilting, or rolling, square bars of steel into the necessary shape, thus making blade, shoulder, and tang in one piece; so difficult was this process, that two wasters in a dozen knives were always thrown aside, and workmen's wages were double. Now, the steel blade, made by this process is welded with the iron tang. Lond. Min. Journ.

Variation of the Boiling Point of Water in Vessels of different Materials.

M. Marcet (Ann. de Chim. et de Phys. v. 449,) has made a series of accurate experiments upon the variations of the boiling point of water, dependent upon the nature of the vessel in which it is made to boil. The following are the results of his researches:—1st. The boiling point of water in glass vessels is from 100.3° to 102° cent., varying with certain circumstances, more especially with the different kinds of glass. In these cases the temperature of the vapor of water is constantly the same, and some hundredths of a degree lower than when water is boiled in metallic vessels. 2d. Whatever the nature of the vessel in which the ebullition takes place, the temperature of the vapor is always lower than that of the water from which it is generated. This difference in the case of glass vessels is about 1.06° cent.; in metallic vessels 0.15° to 0.20° cent. There is only one exception to this rule, which is, when the interior of the vessel, whether of glass, or metal, is covered with a thin coat of sulphur, or gum lac, or any other substance which exercises a repulsion of water; the boiling water and the vapor then have the same temperature. 3d. Contrary to the opinion generally admitted, it is not in metallic vessels that the boiling point is lowest under an increased pressure, but in glass vessels covered internally with a thin coat of the substances mentioned above. 4th. In glass vessels having the internal surface perfectly smooth, and free from foreign matter, water and alcohol can be heated several degrees above their boiling point before they enter into ebullition. Water can thus be heated to 105° cent. If the experiment does not succeed, it is because there is foreign matter adhering to the glass. The experiment may be performed successfully with a new vessel, by first heating sulphuric acid in it to 150° cent., then washing it out with pure water.

Lond. Journ. Arts & Sciences.

Apparatus to enable the Blind to Read and Write.

The Reverend W. Taylor gave an explanation of an apparatus, invented by Mr. Littledale, of York, by which the blind can write and read. The following is a description of the instrument, as given in the local papers:—"Into a case, probably a yard long, and three or four inches square, is fitted a slide, something like one section of a letter-rack used in printing offices for depositing the type when not in use. This slide is adapted to any alphabet, or to arbitrary characters. At one end of the case there is a hammer, under which the paper is placed, and as the letters are brought up successively, by the application of an ingenious contrivance at the opposite end of the case, the hammer is raised, and by its fall they are impressed, or rather embossed, upon the paper, so that blind persons may distinguish them by the touch. When the first letter of a word is printed, the hammer is raised, and that causes the letter to move away, and, at the same time, a space on the paper for the next letter is produced. The blank between each letter, or word, may be increased by raising the hammer twice, or thrice, instead of once. The successive letters are brought up to the hammer, by the means before alluded to. There is also a prepared paper (black,) which may be put over the white paper at discretion, the object of which is to enable persons who have their sight to read the printing better, the force of the hammer causing the black paper to 'set off.' At the hammer end of the case a piece of cloth is attached, to place between the hammer and the type, so that the letter may not be bruised. The type in the slide was made of wood, but to metallic letters the instrument would be equally applicable.—*Proc. Brit. Assoc.*

Lond. Athenæum.

Meteorological Observations.

The President remarked, that meteorological observations required the atmosphere to be in a very peculiar state, in order to insure accurate definition. He believed it was Struve who first remarked, that whenever the temperature of the night sunk much below the mean of the preceding twenty-four hours, no accurate definition of objects was to be expected. Dr. Robinson said the hygrometrical state of the air was of much consequence for astronomical observations; he found that it required to be very near the point of saturation, as a difference between the wet and dry bulb thermometers of more than a degree, or two, precluded all accurate definition, the brighter stars having then a tendency to throw out scintillating lines; and it was only in the moist state of the air that they appeared distinct in themselves, although surrounded by faint colored rays.—Rev. Dr. Scoresby remarked how one branch of physical research bore upon other branches. He believed that the hour at which Lord Rosse found that he could best test the accuracy of figure given to his splendid reflectors, was that which Sir David Brewster had ascertained to be the time of mean temperature for the twenty-four hours.—Lord Rosse said, that the test being the formation of a distinct image of a watch dial placed at a considerable elevation, say 100 feet, above the tower, it was necessary, in order that there should be no tremor of the air, that the temperature within and outside the tower should be as nearly equal as possible, and that this was pretty much the time of the mean temperature of the day—about twenty minutes past nine in the morning.—*(Ibid.)*

Ibid.

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CIVIL ENGINEERING.

On Wooden Railways. By Mr. W. Bridges.

The lecturer commenced by adverting to the fact, that lines of railway were now extended southward to Brighton and Southampton, westward to Exeter, north-west to Birmingham and Liverpool, east and north-east to Norwich and Ipswich—while the city of York, the port of Hull, and all the towns on the direct north route, were left to find a circuitous approach to the metropolis. He, however, contended that although occasion of surprise, this was hardly matter for regret, inasmuch as new science, and new systems might now guarantee the construction of a railway from York to London, at a fourth, or fifth, of the cost ten, or twelve, years ago. Amongst these new systems, the most valuable was the proposed recurrence by Mr. W. Prosser, with certain striking modifications, to the ancient wooden railway. These modifications were—1. The chemical transmutation of the fibre of the wood into a more durable, hard, and almost incorruptible, substance. 2. The employment of a beveled guide wheel, fixed at an oblique angle before and behind each carriage, as a substitute for the flanch, which is the main cause of the wear and tear on the existing railways. By means of this guide wheel, the bearing and carriage wheels would be quite flat, obviating all abrasion of the wood, as well as all liability to oscillation. Under such circumstances, each wheel is permitted to act independently, as with the wheels of an ordinary carriage, and the carriage would be placed upon the ordinary carriage springs. Mr. Adams, the great coach builder, was strongly impressed with the value of the proposed modification, and anticipated, from the use of such carriages, that railway traveling might be henceforth perfectly smooth and noiseless. The process by which the wood is chemically transmuted is the injection of two salts, alkaline and metallic, (known by the name of Paynizing,) which salts, by decomposition, produce an insoluble matter of the timber, arresting and destroying the vegetable principle—so to speak, fossilizing the wood. It was to be noted, that the wood tram was not a novelty—that Mr. Prosser's invention was undeniably a recurrence to the "wisdom of our ancestors," but under such peculiar modifications as made such recurrence eminently desirable, as a means of obviating the incalculable inconveniences and expense of the present mode of railway construction. The first step in this, the right, direction was, the adoption of longitudinal sleepers on the Great Western Railway, and that experiment had been eminently successful—the Great Western, with all its wear and tear, and other evils common to all iron railways, being the best railway yet constructed in Europe. The rails, then, or rather trams, are indurated by the process of Paynization, and are laid down on the principle of the old tram roads, let into wooden sleepers, and secured therein by wedges, forming one great frame of longitudinal and cross sleepers on the leveled surface of the ground. The tires of the wheels being perfectly flat, are kept in the even tenor of their way by two guide wheels before and behind each carriage, fixed at an angle of 45° to the horizontal line; two tires, in their circumference at right angles to one another, embrace the upper and inner edge of the tram. All the wheels being on separate axles, the inner and outer wheels adapt themselves with safety and facility to the sharpest curves. The great advantage of wood over iron, presuming its durability to be secured, is, the adherence of its surface involving about double the tractive power of iron. Much fallacy existed on this subject, and this very adhesion was often alleged as a reason against the adoption of the proposed system; the objection was based on a confusion of friction and adhesion. The driving wheels of the engine are pressed to the rail by a certain weight—say that of the engine itself—and this pressure produces between the wheel and the rail a certain amount of adhesion; upon iron railways this weight is necessarily increased in an inordinate degree, to counterbalance the want of adhesiveness of surface. If the engine were prevented from moving forwards by some immovable obstacle, and were also powerful enough to overcome this adhesion, the wheels of the engine would revolve, although the carriage made no progress; if the obstacle were diminished, so that it will give way before the adhesion is overcome, the engine advances. The magnitude of this obstacle, which is thus capable of being removed, is to be measured by the amount of adhesion—for, if its resistance be greater than that adhesion, the obstacle will not be removed. The total amount of resistance to progress on a railway is correctly represented by such an obstacle; and there is an amount of train which an engine of a given weight will not draw, whatever its power, for its wheels will rather revolve than draw the train. This adhesion, and, therefore, the source of tractive power, is double with an iron wheel on a wood surface, than on a surface of iron. In ascending a gradient, the engine has not only to draw, but to lift; if the adhesion, or bite, be small, the engine must be preposterously large, to draw the train on the level portions of the line; increase this bite, or adhesion, and you may increase the steepness of the gradients, and diminish the weight of your carriage. This immense saving may be made in cuttings and embankments, as well as in the carrying establishment, and in the locomotive power. The truth is, that since the era when it was universally received that the periphery of a wheel could never act as a propulsive fulcrum, engineering science has only been gradually awaking to the immense importance of this one principle of adhesion; and the establishment of sound views here must lead to the universal adoption of wooden railways. A striking proof of the durability of Paynized wood was afforded in the fact, that a tram had been laid down at Messrs. Dalton's wharf, at Vauxhall, on the 15th of August, 1843, and the quantity of coals and other goods that had passed over it up to the 1st of May last, was 37,000 tons, without producing any perceptible effect upon its surface. Prepared beech had recovered the deflection of three-eighths of an inch, resulting from a pressure of 140 tons on the tire of a wheel; and on an experimental tramway the carriages had passed over a number of times, (28,000) equal to a year's traffic on an ordinary railway without obliterating the saw marks.—Mr. Bridges submitted various calculations, to exhibit the probable economy of the process, the result of which is, with respect to superstructure, that a double line might be laid down for about 1700*l.* per mile, instead of from 3500*l.* to 4000*l.*, the actual cost of iron rails. Mr. Vignoles had assumed, that by taking gradients of 1 in 230, instead of 1 in 330, on the Irish south lines, the cost of railways in that country might be reduced from his first estimate of 13,000*l.* to 11,000*l.* per mile. A still wider range of choice, both as to gradients and curves, would be afforded by the adhesive principle of a wooden line, now advocated; and the probable total cost of an Irish line, including earth works, masonry, fencing, land, upper works, carrying establishment, parliamentary expenses, and contingencies, would not exceed 6000*l.*—and, by making use of Scotch fir, instead of beech, (and the greater porosity of the former timber renders it more susceptible of the chemical action,) probably not 5000*l.* per mile. As an important aid to the construction of wooden railways across the soft and boggy districts of Ireland, Mr. Bridges shortly adverted to the very simple and philosophical pile sinking apparatus of Dr. Potts, which substitutes pneumatic power for manual labor and the 'monkey.' Dr. Potts employs hollow tubes of irón, or Paynized wood; the lower extremity is open, and to the upper extremity is affixed an air-tight cap, with a flexible tube of jointed metal, or elastic hose, extending to a receiver, from which the air is extracted by suction; when the air within the tube is thus exhausted, the mud and shingle flow into the tube, which then rapidly descends by its own weight, and the pressure of the external atmosphere. Finally, the importance of the introduction of economical railways into Ireland at this moment were held to be of more consequence than any which legislation, either of Parliament, or a Federal Convocation, or a Repeal Congress, can possibly effect—by giving employment to the population of that country, by developing her vast yet hidden resources, by opening markets for her produce, by uniting her more closely with other countries, and by increasing the happiness and comfort of her inhabitants. An animated discussion ensued.

Mr. Fairbairn observed, that one hundred and fifty years ago wooden railways had been very general over a great part of the north of England, but that the expense of repairs had set invention to work to discover new modes, and this search had resulted in the present system of iron superstructure. There could be no doubt, however, that by such a system as the present the prime cause of the destructibility of the wooden trams might be removed, and, in that case, wooden railways might be re-established with advantages. The invention exhibited by Mr. Bridges, seemed very good and ingenious.

Dr. Scoresby, in commenting on the subject, gave a very interesting account of the working of wooden railways in America, which, from the simple and unornamental character of the works of art, and other causes, were certainly very economical. The desideratum was such a guide wheel as that of Mr. Prosser, which he hoped would now attract attention and investigation.

Dr. Greene characterized the invention as exceedingly beautiful and simple, and illustrated the safety principle of the guide wheel by a diagram, showing that the centre of motion had actually to describe an arc of 45° before the train could be in even the same liability to yield to the centrifugal influence as the present railway train in its natural position. Indeed, he considered the action of this oblique wheel to be totally different in character and rationale from the ordinary flanch.

Inquiries were put to the lecturer as to the different susceptibility of different kinds of timber to become indurated by Paynization.— Mr. Bridges stated that the harder woods, such as oak and *lignum vitæ*, would hardly be benefited by the process, which acted with most effect upon the more porous woods; indeed, he held it to be a sufficient advantage to make Scotch fir equal to oak, without professing to transmute oak, or *lignum vitæ,* into iron.

The President briefly explained the chemical action of the two solutions injected into the wood, resulting in the formation of gypsum, or plaster of paris, within its pores.

Dr. Scoresby gave a detail of experiments he had made to test the effect of salt water under high pressure upon different kinds of timber. He had placed pieces of fir, cork, oak, &c., at such a depth in the sea as to sustain a pressure of eight tons to the inch, and the result was, that every piece of wood became of exactly the same density.

Prof. Byrne suggested that the fibres of the wood should, by means of blocks, be placed vertically, instead of horizontally, to insure greater durability.

Mr. Roberts, admitting that he had not come in until after the lecture was delivered, expressed scepticism as to the value of wood as a superstructure; but the chairman notified to him that certain chemical and mechanical means were employed to harden the wood, and to protect it from abrasion.

Mr. Fairbairn only feared that the weight of the ordinary engine (fifteen tons) would be an obstacle to the realization of all the advantages contended for by Mr. Bridges; but Mr. Bridges, in final reply, opposed to this the affirmation of Mr. Adams, that the weight could be greatly reduced. Moreover, a comparison of even weight with weight was inadmissible here, inasmuch as smooth tires and avoidance of oscillation, would, in themselves, have been a counterbalance even to an increase of weight.—The lecturer briefly returned thanks to the section for their reception of the subject—and, on the suggestion of the chairman, the thanks of the section were voted to Mr. Bridges for his communication.—*(Proc. British Assoc., Sept. 28.)*

Lond. Min. Journ.

Problems on Steam Power. By Mr. Thomas Tate, *Mathematical Master of the Normal School, Battersea.*

Hitherto the investigations have been conducted on purely algebraic principles, but in discussing the following interesting problems, it will be necessary to call in the aid of the integral calculus.

36. To find the relation between the space and velocity of a locomotive, after the steam has been turned off, taking the resistance of the air into account.

By differentiating equation (47) page 72, of Moseley's Mechanical Principles of Engineering, we find,

$$dS = \frac{W}{g} . \frac{V dV}{P} \ldots (1);$$

where V is the velocity in feet per second, corresponding to the space s feet, (estimated from the point at which the steam is turned off,) and P the unbalanced, or moving, pressure at that point,

$$\text{By eq. (1), 26, } R = T\,(r \pm 22.4h) + \frac{q}{V_1^{\,2}} . V^2 = a + bV^2.$$

In this case the unbalanced pressure is an opposing force, and, therefore, it must be taken minus in the general expression (1),

$$\therefore dS = -\frac{W}{g} . \frac{V dV}{a + bV^2}.$$

Integrating between the limits v and V, we have

$$S = \frac{W}{2\,g\,b} \log . \frac{a + b\,v^2}{a + bV^2} \ldots (2).$$

In performing this integration, it will be observed, that when $S = o$, $V = v$.

When $V = o$, that is, when the train comes to a state of rest, the equation becomes,

$$S = \frac{W}{2\,g\,b} \log . \left(1 + \frac{b}{a} . v^2\right) \ldots (3).$$

In order to obtain V in terms of S, let $\frac{W}{2\,g\,b} = \frac{1}{c}$; then by the properties of logarithms, $e^{-cS} = \frac{a+bV^2}{a+bv^2}$, whence we finally find,

$$V = \left(\frac{(a+bv^2)\, e^{-cS}}{b} - \frac{a}{b}\right)^{\frac{1}{2}} \ldots (4.)$$

Example 46. The weight of the train, in example 43, is 100 tons, it is required to determine the distance the train will move after the steam is turned off, assuming the resistance of the air to be the same as in example 28.

Here $a = 100\,(8 + 22.5 \times .5) = 1925$, $b = .33$, $W = 224000$, and $v = 44$, therefore, by eq. (3,)

$$S = \frac{224000}{2 \times 32 \times .33} \log.\left(1 + \frac{.33}{1925} \times 44^2\right) = 3024 \text{ feet nearly.}$$

Observation. Comparing this result with that of Example 43, it appears that 500 feet are due to the resistance of the atmosphere.

37. To determine the relation between S and V, assuming the pressure upon the piston to be constant, as in the atmospheric locomotive.

Let R_1 be the total pressure of the elastic fluid referred to the circumference of the wheel, then, as the opposing pressure is given in eq. (2,) 36 we have $P = R_1 - R \times R_1 - a - bV^2 = c - bV^2 \ldots (1,)$ substituting this value of the accelerating pressure in eq. (1,) 36, and integrating as before, we obtain,

$$S = \frac{W}{2gb} \log. \frac{c - bv^2}{c - bV^2} \ldots (2.)$$

Here v is the velocity with which the engine starts. When the engine attains a maximum speed the accelerating force must be nothing, that is, we must have $c - bV^2 = 0$, or $V = \sqrt{\frac{c}{b}}$; but when this takes place, the denominator of the logarithm becomes nothing, and then $S = \infty$. Hence it appears that the train never does attain its maximum speed, as that can only take place when the space moved over is infinite.

Example 47. Through what space will the engine, in the last example, have to move in order to acquire the speed of 30 miles per hour, supposing the pressure of the elastic fluid upon the wheel to be 4000 lbs., and that the engine starts with the velocity of 10 feet per second?

Here $c = 4000 - 1925 = 2075$, $b = .33$, $W = 224000$, $V = 44$, and $v = 10$; then, by eq. (2,)

$$S = \frac{224000}{2 \times 32 \times .33} \log. \frac{2075 - 33}{2075 - 638.8} = 3720 \text{ feet.}$$

38. To determine the relation of t and V, when the elastic fluid acts as in the last problem.

For this purpose we have the general equation,

$$P = \frac{W}{g} \cdot \frac{dV}{dt}.$$

(Moseley's Mechanical Principles of Engineering, p. 94,) therefore, by eq. (1,) 37, we have,

$$c - b\,V^2 = \frac{W}{g} \cdot \frac{d\,V}{d\,t};$$

$$\therefore t = \frac{W}{g} \int_V^v \frac{dV}{c - bV^2} = \frac{W}{2 g c^{\frac{1}{2}} b^{\frac{1}{2}}} \log. \frac{(c^{\frac{1}{2}} + b^{\frac{1}{2}} V)(c^{\frac{1}{2}} - b^{\frac{1}{2}} v)}{(c^{\frac{1}{2}} - b^{\frac{1}{2}} V)(c^{\frac{1}{2}} + b^{\frac{1}{2}} v)};$$

where v is the initial velocity, or what V becomes when $t = 0$.

When the engine attains its maximum speed, $V = \sqrt{\frac{c}{b}}$; but in this case the factor $c^{\frac{1}{2}} - b^{\frac{1}{2}} V = 0$, and then the expression for t becomes infinite, thus confirming the deduction made in 37.

Example 48 In what time will the engine, in example 47, attain the speed of 30 miles per hour?

Here,

$$t = \frac{224000}{64 \times .574 \times 45.5} \log. \frac{(45.5 + .574 \times 44)(45.5 - .574 \times 10)}{(45.5 - .574 \times 44)(45.5 + .574 \times 10)} = 2.2 \text{ min.}$$

39. To determine the relation between S and V, when the pressure of the steam in the cylinder is a given function of the velocity.

Let the total effective pressure of the steam upon the driving wheel be expressed by the equation $R_1 = f(V,)$ then, by eq. (1,) 37,

$$P = f(V) - a - bV^2;$$

$$\therefore S = \frac{W}{g} \int_V^v \frac{V\,dV}{f(V) - a - b\,V^2} \quad \ldots (1.)$$

If, therefore, $f\,V$ were known, the integration might be effected; but, independently of experiment, it is impossible to discover any exact analytical representation of this function; for, amongst other circumstances of less complexity, it evidently depends upon the variable discharge of the steam into the cylinder, arising from the unequable motion of the piston in each stroke, and the consequent change of temperature and density of the steam. If, however, the relation of the mean pressure and velocity were determined by experiment in three, or more, cases, the law of relation might be ascertained sufficiently near, for practical purposes, by the method of interpolation. In the absence of such data, an approximation to the truth will be obtained, by supposing the pressure to be inversely as the velocity, or what is the same thing, by assuming the working power of the engine to remain constant. Proceeding on this hypothesis, let U be the work of the engine per second, then $R_1 \times V = U$; and $\therefore R_1$, or $f\,V = \frac{U}{V}$, substituting in equation (1,)

$$S = \frac{W}{g} \int_V^v \frac{V^2\,dV}{U - a\,V - b\,V^3} \quad \ldots (2.)$$

Integrating this expression, between the limits v and V, first when the resistance of the atmosphere is neglected, we find,

$$S = \frac{W}{g\,a} \left\{ \tfrac{1}{2}(v^2 - V^2) + \frac{U}{a}(v - V) + \frac{V^2}{a^2} \log. \frac{U - a\,v}{U - a\,V} \right\} \quad \ldots\ldots (3.)$$

In order to integrate the general formula, it is necessary to observe that, since U, a, and b are essentially positive, when the engine ascends the incline, the expression in the denominator will have one positive and two imaginary roots, (see Hymer's Equations, p. 82.) Let e, therefore, be the real root, then,

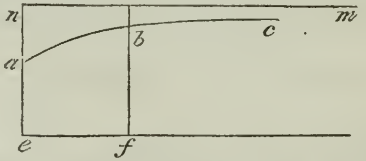
$$S = \frac{W}{g} \int \frac{V^2 \, dV}{U - aV - bV^3} + C = \frac{-W}{g\,b} \int \frac{V \ dV}{V \quad + \frac{a}{b} V - \frac{U}{b}} + C =$$

$$\frac{-W}{g\,b} \int \left\{ \frac{D\,dV}{V - e} + \frac{(AV + B)\,dV}{(V - a)^2 + \beta^2} \right\} + C =$$

$$\frac{W}{g\,b} \left\{ D \log. \frac{v - e}{V - e} + \frac{A}{2} \log. \frac{(v - a)^2 + \beta^2}{(V - a)^2 + \beta^2} + \frac{Aa + B}{\beta} \left(\tan.^{-1} \frac{v - a}{\beta} - \tan.^{-1} \frac{V - a}{\beta} \right) \right\} \quad (4.)$$

When the motion of the train becomes uniform, $V^3 + \frac{a}{b} V - \frac{U}{b} = 0$, the real root of which is e. By putting this value for V in the above expression, the term $\log. \frac{v - e}{V - e}$ becomes infinite. Hence it appears that the maximum speed of the engine cannot be attained until it has gone over an infinite distance.

Applying the same reasoning to equation (3,) we have for the equation of uniform motion, or maximum speed, $V = \frac{U}{a}$, and for this case $S = \infty$. The assumption $fV = \frac{U}{V}$, upon which this remarkable result has been based, evidently gives the moving pressure rather below what in ordinary cases it really is; therefore, *à fortiori*, our locomotive engines never do attain their maximum speed. At the same time it is important to observe that our expression indicates that the speed undergoes but little increase after it has attained a certain limit. This analytical deduction will account for the discrepancies in the statements of two of our most distinguished engineers, Brunel and Stephenson, relative to this matter, the former making the distance at which the maximum speed is attained about 8 miles, the latter only about 4 miles.



The relation of speed and space may be represented by the approach of a curve a, b, c, towards its asymtote n, m, where b, f, is the velocity corresponding to the space e, f, moved over, and e, n, the maximum; requiring the engine to move over an infinite distance to attain that speed, but showing at the same time that this maximum speed is *nearly* attained in a finite time.

Example 49. When will an engine of 60 horses power attain a speed of 30 feet per second, or about 20 miles per hour, the weight of the train being 50 tons, the resistance of friction 8 lbs. per ton, and the velocity of starting 10 feet per second?

In this case, $U=\frac{60\times 33000}{60}=33000$; $v=10$; $V=30$; $a=50\times 8=400$; $W=50\times 2240$; $g=32$; then, by eq. (3,)

$$S=\frac{50\times 2240}{32\times 400}\left\{\tfrac{1}{2}(10^2-30^2)+\frac{33000}{400}(10-30)+\frac{33000^2}{400^2}\log. 1.38\right\}=$$

1240 feet.

Example 50. Through what space will the engine in the last example have to move in order to attain the speed of 70 feet per second, or 47 miles per hour?

$$\text{Here } S=\frac{35}{4}\left\{-2400-4950+6806.25\times\log. 5.8\right\}=7.6 \text{ miles.}$$

Example 51. When will the engine in the last example attain the speed of 60 feet per second, or 41 miles per hour?

Proceeding, as in the last example, we find $S=3.7$ miles.

40. To determine the relation between t and V, supposing the steam to act as in the preceding problem.

When the resistance of the atmosphere is neglected, we have $P=\frac{U}{V}-a$; therefore, by substitution in the general formula 38,

$$dt=\frac{W}{g}\cdot\frac{dV}{\frac{U}{V}-a}=\frac{W}{g}\cdot\frac{V\,dV}{U-aV}=\frac{W}{g}\left\{-\frac{dV}{a}+\frac{U}{a}\cdot\frac{dV}{U-aV}\right\}$$

Integrating between the limits of V and v,

$$t=\frac{W}{ag}\left\{v-V+\frac{U}{a}\log.\frac{U-av}{U-aV}\right\}$$

and so on to the general case.

Here again we observe, that when the speed is a maximum the time is infinite.

Example 52. In what time will the engine, in example 49, acquire the speed of 60 feet per second?

$$\text{Here, } t=\frac{50\times 2240}{400\times 32}\left\{10-60+\frac{33000}{408}\log. 3.22\right\}=6.7 \text{ minutes.}$$

41. Having introduced the use of a more recondite analysis, it may be interesting to apply the same method to the investigation of the Problems, 2, 7, and 8.

If l be the whole stroke, including the clearance c, U_1 the work done expansively at x feet of the stroke, corresponding to P_1 pressure of the steam, then by Moseley's Mechanical Principles, (page 55,)

$$U_1=\int_x^h P_1\,dx\ldots(1.)$$

By the formula of relation between the volume and pressure of the steam, (page 102, vol. xl.)

$$P_1 = \frac{1}{\frac{x}{h}\left(\frac{1}{P} + .00268\right) - .00268} = \frac{1}{a\,x - b};$$

$$\text{where } a = \frac{1}{h}\left(\frac{1}{P} + .00268\right); \text{ and } b = .00268.$$

Substituting this value of P_1 in eq. (1,) we have,

$$U_1 = \int_x^h \frac{d\,x}{a\,x - b} = \frac{1}{a}\log.\frac{a\,x - b}{a\,h - b} \dots (2.)$$

To determine x in terms of U_1, we find from the properties of logarithms,

$$e^{a\,U_1} = \frac{a\,x - b}{a\,h - b}, \therefore x = \frac{1}{a}\left\{(a\,h - b)\,e^{a\,U_1} + b\right\} \dots (3.)$$

When $x = l$ in equation (2,) the whole work in one stroke becomes,

$$K\,U \text{ or } L\,K\,(l - c) = K\left\{\frac{1}{a}\log.\frac{a\,l - b}{a\,h - b} + P(h - c) - p(l - c)\right\} \dots (4.)$$

Where L represents the sum of the pressures opposing the motion of the piston, as in eq. (A,) 10.

When the work is required in terms of the water evaporated, the P, in this expression must be eliminated, by the expression given in 14.

Substituting the values of U_1 and U_2 in the expression given in 7, we find,

$$V = \left\{\frac{2\,g\,K}{W}\left(\frac{1}{a}\log.\frac{a\,x - b}{a\,h - b} + P(h - c) - p(x - c) - L\,x\right)\right\}^{\frac{1}{2}} \dots (5.)$$

If R be put for the sum of all the resistances upon each inch of the piston, viz., $F + L_1(1 + f) + p$, then the maximum velocity will take place when, $P_1 = R = \frac{1}{a\,x - b}$; from which we find,

$$x = \frac{1}{R\,a}(1 + b\,R) \dots (6.)$$

This is the expression for the position of the piston, when the maximum velocity takes place; it is more accurate than that given in 8, inasmuch as Pole's formula gives the relation of the volume and pressure of the steam more accurately than Marriotte's law. It may not be improper here to observe, that the expression given for this point in the paragraph just referred to, neglects the pressure of the vapor in the condenser.

Example 52. Required the work performed upon 1 inch of the piston, in example 1.

Here,

$P = 28$, $l = 9$, $h = 3$, $c = 0$, $K = 1$, then by for. (4,) $a = \frac{1}{3}\left(\frac{1}{28} + .00268\right) = .01279$, $b = .00268$, and $U = \frac{1}{.01279}\log.\frac{.01279 \times 9 - .00268}{.01279 \times 3 - .00268} + 28 \times 3 = 174.$

It will be observed that this result nearly coincides with that obtained in example 1.

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FRANKLIN INSTITUTE.

Extracts from the Reports of the Judges appointed to examine the Articles offered at the Fourteenth Exhibition of American Manufactures; held October, 1844.

(Continued from Page 169.)

The Committee of Judges on Hardware were highly gratified in entering upon the duties of their appointment to notice the general improvement in the hardware exhibited this season, particularly in cast-iron and hollow ware. In their investigations they have examined every specimen enumerated in the catalogue furnished them by the Actuary. In consequence of the number of articles submitted to them, their remarks must necessarily be brief: the first article is—

No. 1001, one case of samples gilt buttons, made by Wadham, Webster & Co., Wolcottville, Conn., deposited by makers. These are a beautiful article, elegantly finished, but in no respects superior to those exhibited at the last exhibition. In some of the specimens there is room for better taste and skill in the die work of the figures.

No. 1003, three saw setts, made by J. Flegel, Philadelphia, deposited by Jarvis & Webster. The committee could not discover any particular merit in these articles.

No. 1004, one card of files, assorted, made by Robert Murphy, Philadelphia, deposited by maker. These specimens embrace nearly all the varieties of the small and delicate files used by jewellers, and particularly dentists; in their general appearance and finish they closely resemble the celebrated "Stubbs" Lancashire files. We learn too that the manufacturer can furnish an article fully equal to the specimens, at prices varying from fifteen to twenty-five per cent. below the same description of English files: with perseverance and a determination to excel, by the maker, this description of English files must soon cease to be imported. For his success in producing an article so nearly like the small and fine Lancashire files, the committee think the maker entitled to the premium of a silver medal.

No. 1005, a frame and gearing with suspended doors, made by W. J. Forsyth, Philadelphia, deposited by maker. In this contrivance the committee believe that there is nothing new.

No. 1006, half dozen patent coffee mills, made by John Rittenhouse, Germantown, Pennsylvania, deposited by Joseph G. Hensey. These are well and beautifully made, and sustain the high reputation which the maker has acquired. For their general excellence and finish the committee think the maker is entitled to the award of a certificate of honorary mention.

No. 1007, a card of rasps and files, made by George Machen, Philadelphia, deposited by maker. These are a good article, fully equal to any ever exhibited; they are well cut, of good proportions and strength, and in the strength of the tangs are superior to the foreign article of the same description; the maker is entitled to a certificate of honorary mention.

No. 1008, one silver mounted hunting sword, made by Jacob Faser, Philadelphia, deposited by maker. This is a well made article, got up in superior style, and highly creditable to the maker's skill and taste.

No. 1009, four pieces britannia ware, made by Joseph Morrow, Philadelphia, deposited by maker. These are a well made article; the color of the metal is good, the surface free from "blows," and finely polished; the soldering of the spouts and handles remarkably neat, and in general finish will compare favorably with the same description of foreign goods.

The forms of these articles might be improved without adding to the expense of the manufacture, by the makers exercising a little more taste. The committee think these specimens entitle the makers to the award of a certificate of honorary mention.

No. 1010, one revolving rifle gun, made by John Herr, Freindsburg, Berks county, Penna., deposited by Christr. J. Fell; in this article the committee could not find much to admire either in taste, or workmanship.

No. 1011, one coffee mill, made by A. Pritz, Hanover, Penna., deposited by A. Maslin; this appears to be a fair, serviceable article.

No. 1012, three cast-iron planes, made by the Savage Manufacturing Company. Hanover county, Maryland, deposited by Yarnall & Walton. These are new articles, and appear to be well made for service; their merits, however, are not known to the profession.

No. 1014, one stand of sample gravitating locks, made by S. C. Bemis, Springfield, Massachusetts, deposited by E. F. Moody. These appear to be a good article, well and tastefully made.

No. 1015, one of Jenk's patent carbine, made by N. P. Ames, Chicopee Falls, deposited by E. S. Handy & Co. This article is well made in every respect in strength and proportions; it is faultless. Of its peculiar merits in loading at the breech, the committee are unable to give an opinion.

No. 1017, one case of rules, made by Bremner & Co., New York, deposited by Foote & Thompson. These appear to be a well made and good article: creditable to the maker.

No. 1018, one case of sample wrenches, made by Merrick, Springfield, Massachusetts, deposited by Foote & Thompson. These are good, fully equal to any others in the exhibition.

No. 1020, one case of guns, rifle and musket, made by John Krider, Philadelphia, deposited by maker. All these articles are excellent specimens of the maker's skill; in strength, just proportions, good taste, and excellence of workmanship and finish, the committee think them the best articles of the kind ever exhibited, and fully entitle the maker to the award of a silver medal.

No. 1021, four bundles of scythes, made by Mansfield & Holman, Smithfield, Rhode Island, deposited by Wm. P. Cresson & Co. These are all well made, and fully equal in all respects to any exhibited at former exhibitions. The domestic manufacture of this article, has, for several years, entirely excluded the importation of the foreign article.

No. 1022, one case of rules, made by Herman Chapin, New Hartford, Conn., deposited by William P. Cresson & Co. These are a good, creditable article.

No. 1023, two card handles, made by F. Stanly, N. Britain, Conn., deposited by W. P. Cresson & Co.

No. 1024, eight planes, made by E. W. Carpenter, Lancaster, Pa., deposited by Yarnall & McClure; these are a well made, and appear to be a good, serviceable article.

No. 1026, one card and four packs of pins, made by Slocum, Jillson & Co., Waterbury, Conn., deposited by F. V. Krug & Co.; this being comparatively a new article of American make, claimed much of the time and close attention of the committee. In the production of this article the manufacturer has been eminently successful; the specimens exhibited are well made in every respect, the heads smooth, the shanks well proportioned, smooth, and elastic, and the whole article beautifully finished. The committee think the maker entitled to the award of a silver medal.

No. 1027, three scythes, made by Hale, Waters & Co., Millbury, Massachusetts, deposited by Smith & Lewis; these are good, and equal, in all respects, to any other specimens exhibited.

No. 1028, two cards of door locks, latches, and door springs, made by T. L. Littlefield, Philadelphia, deposited by maker; these are all well made, and beautifully finished articles, in design and execution highly creditable to the maker; they appear to be well contrived for use, and worthy the attention of the trade. The maker is entitled to the award of a certificate of honorary mention.

No. 1029, one frame hay and manure forks, made by John F. Hopkins, West Cambridge, Massachusetts, deposited by David O. Prouty. These are elegant specimens of the maker's skill, the forks being beautifully finished, and highly elastic; the maker is entitled to the award of a certificate of honorary mention.

No. 1031, forty sheets of sand paper, made by Betts, Lafferty & Co., Philadelphia, deposited by maker. This is a good article of the usual quality to be found in the trade.

No. 1032, one case of butchers' knives, &c., made by Henry Huber, Jr., of Philadelphia, deposited by maker; we are glad to notice the improvement presented in these specimens; they are an article of very general demand, and have constituted quite an item in our importations. The specimens are of good proportions and strength, and withal well finished; the maker is entitled to the award of a certificate of honorary mention.

No. 1035, one case samples of awl blades, made by Thorp & Hall, Philadelphia, deposited by makers; these are a new article of American manufacture, being the first, we believe, exhibited; a little more experience, we doubt not, will enable the makers to produce an article in all respects equal to any imported. For the general excellence of these specimens, the committee think that the Institute will be warranted in awarding a certificate of honorary mention.

No. 1037, one bench vice, made by C. C. Chapman, Philadelphia, deposited by maker; this appears to be a well finished article: it is adapted to holding parallel and wedge form figures; for the design and workmanship, the maker is entitled to a certificate of honorary mention.

No. 1038, one box of cotton and wool cards, made by Prentiss & Brother, Philadelphia, deposited by maker; these are a good article, and fully sustain the makers' reputation.

No. 1039, lot of sad irons and hollow ware, made by Savery & Co., Philadelphia, deposited by makers; it is highly gratifying to observe the very great improvements which have been made in the manufacture of these articles. The sad irons are remarkably smooth in the casting, the handles well made, of good form, and the face and sides of the iron finely finished. The hollow ware is decidedly the best ever exhibited; the form is good, remarkably smooth, and of great evenness;—for these excellencies the committee think the makers entitled to the award of a silver medal.

No. 1040, a case of lever suspender buckles, made by James Bingham, Philadelphia, deposited by maker; these articles are silver, and should more properly come under the notice of the committee on silver ware; in the judgment of the committee, however, they are a neat, well made article, and highly creditable to the maker's taste.

No. 1042, eight signal lanterns, made by Wm. Porter, Trenton, N. Jersey, deposited by Charles Jewell; these are a fair article.

No. 1043, one fifty blade knife, made by W. Richardson, Philadelphia, deposited by C. C. Watson; the committee doubt whether this is American make, at all events, it is a useless article, and of inferior workmanship.

No. 1044, a case of britannia ware, made by Hall, Boardman & Co., Philadelphia, deposited by makers; these articles will bear examination; the color of the metal is a good imitation of the English "britannia metal," the surface is good, and finely finished, the soldering neat; in all respects they are highly creditable to the makers, and fully equal to any exhibited. The forms of many of these articles might be more graceful, without additional expense to the maker; the makers are fully entitled to the award of a certificate of honorary mention.

No. 1048, one pair of steel skates, made by Frowert, Philadelphia; these are disreputable to the maker and depositor, Frank Shoemaker.

No. 1061, one case of tailors' shears and hair scissors made by R. Heinisch, Newark, New Jersey, deposited by J. H. Harkness, Philadelphia; these articles are, in all respects, worthy the high reputation of the maker. In no branch of American cutlery has greater perfection been attained than in this; the committee have met with nothing equal to it from the most celebrated foreign workshops. In weight, strength, proportions, adaptedness, and beauty of finish, nothing more can be desired; for these excellencies the committee think the maker entitled to a silver medal.

No. 1062, two shovels, one spade, and one saw, made by A. Wood & Brother, Philadelphia, deposited by makers; these are good articles, and show that the quality is not declining.

No. 1063, one patent metallic door plate, made by J. L. Bowker, Philadelphia, deposited by maker; we confess that the word patent always startles us—we generally find something worthless beneath it:—of the peculiar merits of this article we have no opinion to give.

No. 1064, lot of lock castings, made by C. Manfield, Elizabethtown, deposited by James Bradfield; these are good, the surfaces being smooth and free from imperfections.

No. 1065, one case of locks, made by August Prutzman, Philadelphia, deposited by maker; the most remarkable and interesting specimen in this case is a *safety lock:* this lock presents an ingenious combination of the many tumbler lock of Mr. Barron, with the detector principle of Chubb, and several other devices of additional security. The key hole is covered with a strong boss of brass, which is imbedded in the face of the lock, and secured by three buttons on the combination principle, admitting seven hundred and twenty-nine changes; within the lock is a steel plate covering, the key hole of which can be removed only by pressing a secret spring placed within and near one corner of the lock. This spring must be pressed by a small steel wire, and at the moment of removing the plate sets off an alarm bell which continues to sound for several minutes. The tumblers are ten in number, five are pressed down in unlocking, and five are pressed up. The tumblers are not connected with the bolt, but when they are thrown into the proper position, allow a stop of steel to take the position required for the freeing of the bolt, which is then drawn by a knob handle independent of the key. From this brief description, it will be seen that this lock is of most ingenious contrivance. The workmanship is of the very best kind; the committee think that the ingenuity, skill, and excellent work exhibited in this lock entitle the maker to the award of a silver medal.

No. 1069, one card of files, made by Thomas Perrins, Philadelphia, deposited by maker; these files are of good strength and proportions, and appear to be well cut; part of them are, however, in a soft state. The maker certainly deserves credit for the strength he has given to the tangs of these files—the English being generally too weak in this respect; the whole card will compare favorably with any others in the exhibition.

No. 1070, one card of butt hinges, made by the New England Butt Hinge Company, Providence, R. Island, deposited by E. J. Fenner; this article is becoming one of great value and importance in American industry; it will soon take its place among the list of other American goods which have entirely excluded the foreign. These specimens are all loose, parliament, broad and narrow hinges; the samples exhibited, embracing the card and a number of bundles taken from the shelves of the depositor, have been subjected to most careful examination; the committee find them to be strong, well proportioned, the joints good, the castings remarkably smooth, free from defects, and the screw holes round and properly countersunk. The committee think them the best article of the kind ever exhibited, and entitle the maker to the award of the silver medal.

No. 1071, lot of iron rivets, assorted, made by Farris, Edes, & Co., Plymouth, Massachusetts, deposited by Heaton & Denckla; these appear to be a good article, the smaller samples particularly.

No. 1072, one card of files, made by W. & R. Davis, New York, deposited by Heaton & Denckla; these are samples generally of the smaller kinds, and imitations of the "Lancashire;" they are very creditable to the makers, and prove what we may expect from them with a little more practice in their manufacture; they are not, however, equal to No. 1004.

No. 1073, three cards of locks, made by Lewis McKee & Co., Terrysville, Connecticut, deposited by Heaton & Denckla; it is surprising how rapidly American skill is meeting the wants of the community; the samples are closet and chest locks, for which there is an almost unlimited demand. These articles are well made, strong, adapted to use and wear, and must soon entirely supersede foreign importations.

No. 1075, one card of spring cutlery, pocket and pen knives, made by Bradley & Beecher, Naugatuck, Connecticut, deposited by Heaton & Denckla; these are a good, close, imitation of the fine English knife; a few years ago they would have obtained for the makers the highest honors of the Institute—at present they only take rank among the same articles made by other American makers. In saying this we do not mean to depreciate these goods, but rather to show the progress which this branch of our arts has made.

No. 1077, one lot of carpenters' planes, made by John Colton, Philadelphia, deposited by maker; the committee after a careful comparison of these planes with those deposited by other makers, decide them to be the neatest and best finished in the exhibition, and entitle the maker to the award of a certificate of honorary mention.

No. 1080, two cases of hooks and eyes, made by S. J. North, New Britain, Connecticut, deposited by J. D. Byerly; these are good and creditable to the maker.

No. 1083, one card, or case, of fine table cutlery, made by J. Russell & Co., Greenfield, Massachusetts, deposited by Curtis & Hand; in these specimens we have another gratifying evidence of the rapid advance which this branch of American cutlery has made; this work is highly creditable to the makers, and will bear a close comparison with the best English table cutlery; it is well forged, tempered, ground, and polished, and finished in good taste, for all which the makers are entitled to the award of a silver medal.

No. 1084, one case of wood screws, made by the New England Company, deposited by Curtis & Hand; the committee think that these screws cannot be surpassed, or improved, in any respect; they are equal to the specimens for which the Company obtained the medal of the Institute at the last exhibition.

No. 1085, one card of screw wrenches, made by S. Merrick, Springfield, Massachusetts, deposited by Curtis & Hand; these are a good article, but in no respects better than have been deposited in former exhibitions.

No. 1086, one card of plane irons, made by W. Field, Pawtucket, Rhode Island, deposited by Curtis & Hand; these appear to be well made, highly creditable to the maker, and are said to give general satisfaction to the trade. The committee, however, think that they are not superior to what we have had at former exhibitions.

No. 1087, one card of pins, assorted, made by Mitchell & Witherill, New York, deposited by Curtis & Hand; the committee devoted a large portion of their time to the examination of these pins, and though they are highly creditable to the makers' skill, they lack, in the estimation of the committee, the smoothness of head, and general fineness of finish observed in specimens No. 1026; yet, on account of their near approach to No. 1026, in general excellence, the committee think the maker entitled to the award of a certificate of honorary mention.

No. 1088, one card of bolts, made by Mattison, Russell & Co., New Britain, Connecticut, deposited by Curtis & Hand; these are a good article, and well adapted to the purposes for which they are intended.

No. 1089, one card of saws, made by Jonathan Paul, Philadelphia, deposited by Thompson & Carr; in this article there is nothing to elicit particular notice: they are good, and a fair specimen of what our manufacturers of that article usually furnish.

No. 1090, one case of trunk locks, made by Goodwin & ———, Terrysville, Connecticut, deposited by Thompson & Carr; these are comparatively a new article to which American industry has been applied; the makers have been quite successful in producing a strong, neat, well finished article, superior, in these respects, to the ordinary English trunk lock; they are entitled to the award of a certificate of honorary mention.

No. 1091, one patent safety lock, made by Thomas P. Murphy, deposited by maker; this is a safety lock, and is designed particularly for banks; it is worked with three keys, and may be said to consist of three locks securing each other. The design of the maker is that the keys shall be kept by separate persons, as the lock appears to be so ingeniously contrived as to defy the art of picking; it follows then that concert among the keepers of all the keys is indispensable, in order to open the lock. This lock is most ingeniously contrived and skilfully made; the workmanship is of the very best description—whether the inventor and maker of this ingenious and complicated lock is applying his talents and skill to the best account, it is not for the Franklin Institute to judge, but for the ingenuity, skill, and excellence of workmanship the committee think the maker entitled to the award of a silver medal.

No. 1092, three hones, made by W. McCalla, Philadelphia, deposited by maker; the committee could not discover the particular merit of these hones, if they possess any.

No. 1094, lot of circular saws, made by Hoe & Co., New York, deposited by Edward Frick; these are good, free from winding, and equal to the article in general use.

No. 1096, one repeating rifle, made by H. Gross, Tifton, Ohio, deposited by J. C. Smith; the workmanship on this article is beautiful in every respect, and extremely creditable to the maker. Of the value of this invention the committee cannot speak, unless it be to secure business for the surgeon, or the undertaker.

No. 1097, one safety bolt, made by Howell & Smith, Philadelphia, deposited by makers; this bolt is so constructed as that when it is "pushed home" it is secured in its place by a small lock forming one of the staples of the bolt. The article is very well made, but it is doubted by the committee whether the inconvenience of locking and unlocking the bolt, added to that of occasionally mislaying, or losing, the key by those with whom it may be entrusted, will not prevent them from being generally used.

No. 1100, one stand of sample stair rods, made by Edward Jones, Philadelphia, deposited by maker; the finish of these specimens is highly creditable to the skill and taste of the maker; in these respects they are all that can be desired—he is entitled to a certificate of honorary mention.

No. 2007, three boxes of hooks and eyes, made by S. J. North, New Britain, Conn., deposited by E. H. Worne; these are a fair and good article.

No. 2041, one box of curtain pins and bureau knobs, made by J. B. Chevalier, Philadelphia, deposited by W. M. Muzzy.

No. 2045, two shovels and one spade, made by T. C. Wood, Philadelphia, deposited by maker; these are beautiful specimens of the maker's art, and in all respects well made.

No. 2053, three grain shovels and scythe snead, made by John Weightman, Philadelphia, deposited by maker; in excellence these will compare with any in the exhibition.

No. 2501, three rakes, wood and iron, made by Henry Porter, Northumberland county, Penn., deposited by G. H. Brown; these appear to be well made, and adapted to the purpose for which they are used.

No. 2551, three shovels, made by J. Richards, jr., Philadelphia, deposited by maker; these also are well made; as a general remark the committee think that in the articles of shovels and scythes there is but little room for improvement.

No. 2562, one case of shuttles, made by E. D. Tripp, Trenton, N. Jersey, deposited by A. W. Tiffany; these are well made, and unusually well finished; they are so highly creditable to the maker, that the committee think him entitled to the award of a certificate of honorary mention.

No. 2570, wire screens, riddles, &c., made by J. & D. Sellers, Philadelphia, deposited by John McClane; these goods the committee think cannot be improved; the weaving is perfect; they are, however, only fair samples of what these manufacturers have long since exhibited and furnished to the trade. It is pleasant thus to see a good reputation sustained.

No. 2590, a coffee urn, made by John Harned, Philadelphia, deposited by maker.

No. 2619, counter scales, made by G. R. Moore, Philadelphia, deposited by maker; these are a good, serviceable article.

No. 2623, three scales, made by T. Meyer & Co., Philadelphia, deposited by Gray & Co.

No, 2612, one set of platform and counter scales, made by J. D. Dale, Lansingburg, New York, deposited by Gray & Brother; the platform scales come under the notice of the judges on models and machinery. The counter scales appear to be well made, but in the judgment of the committee they are rather complicated for ordinary use; the slightest derangement must subject the buyer, or seller, to loss, and they may be made the means of petty frauds in the hands of knaves.

No. 1101, one curriers' knife, made by Stephen Parry, Philadelphia, deposited by maker; this is a well made and beautiful article in every respect, and entitles the maker to the award of a certificate of honorary mention.

No. 1098, card samples of brass molasses gates and turn buttons, made by G. Jordan, Philadelphia, deposited by maker; these are creditable to the maker.

No. 1106, one case of pocket and pen knives, made by W. Wild, New York, deposited by W. Murdock; the committee have examined these articles with great care—as it is one which enters largely into our foreign purchases;—it is a branch of business affording great scope for skill and good taste. In the judgment of the committee these specimens, while they do not show any decline in this branch, are not superior to specimens deposited in former exhibitions.

Three mill saws, a good article for the purpose, (without No.)

No. 1103, one circular saw, made by Chas. Johnson, Philadelphia, deposited by Curtis & Hand; this article is equal to any others in the exhibition.

No. 2658, lot of wire screens, made by Thomas S. Speakman, Philadelphia, deposited by maker; these are equally as well made as others in the exhibition.

No. 2560, sample cards and bundles of cast-iron butt hinges, made by Morris, Tasker & Morris, deposited by makers; the sample cards embrace several varieties of fast and single joints, and are very creditable to the makers. The committee examined with great care the quality of those in bundles, and they regret to say that they found them to be inferior to the samples; the casting is rougher, the joints less perfect, and the screw holes irregular. These are defects which must be corrected before the article can find favor with the trade, or the public, and we doubt not that the well known ability, perseverance, and skill of the makers, will enable them to produce an article in all respects equal to any in the market.

AMERICAN PATENTS.

List of American Patents which issued in the month of July, 1844, with Remarks and Exemplifications. By Charles M. Keller, *Examiner of Patents.*

1. For an improvement in *Ploughs;* Jonathan Mooerers, Hazleton, Luzerne county, Pennsylvania, July 1.

The standard, or sheath, of this plough is cast with the mould board, and is rebated on the land-side to receive the cutter, which thus overlaps it and the mould board; the cutter being fastened by a bolt which passes through it and the land-side, and by a projection from the share that holds the lower end, the upper end being fastened to the beam, which it enters in front of the standard, by a plug, or wedge.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the cutter constructed and arranged as described, in combination with the sheath and beam, as above set forth."

2. For an improvement in the method of securing *Boring Machines* to pieces of timber that are to be bored; Peter Baylor, near Salem, Columbiana county, Ohio, July 1.

The machine is secured to the timber by means of a hook jointed to the end of a lever, connected with the machine by a bolt that passes through a slot in the lever, and another in an axle, in such manner that the position of the lever and hook may be varied to suit timbers of various sizes, &c.

Claim.—"What I claim is the combination of the oblong, perforated, vibrating axle, the oblong, perforated lever, connected thereto by a screw bolt, the hook for grasping, or gripping, the article to be bored, with the machine for boring, in the manner and for the purpose set forth."

3. For an improvement in *Bee Hives, or Palaces*: Jacob D. Fulkerson, Unity, Columbiana county, Ohio, July 1.

The palace is a square box divided into four compartments by two vertical partitions at right angles, the one that is parallel with the two doors, on the front and back, extends from the bottom to the top, where there are apertures for ventilation; each of these apartments is divided into three stories by shelves that incline from the doors towards the main partition, the back edge of the shelf not coming quite up to the partition, but leaving sufficient space for the entrance of the bees, there being vertical partitions that extend from the bottom of one shelf to within a short distance of the top of the next. The main partition only extends down from the top to the third shelf, and from the lower end of it two boards extend out, one on each side, at an inclination the reverse of the shelves, and about half of the lowest compartment has the same inclination, thus leaving a passage for the bees. The under edge of the last named inclined board, and the bottom of the lowest compartment have pieces of glass attached to them, and of less inclination, that form receptacles to catch the moth, and prevent their entrance to the hives; below these pieces of glass are placed the lighting boards, and shield boards.

Claim.—"What I claim is the combination and arrangement for defending the hopper-formed entrances, by means of the glass placed around the entrance thereof, and the shield boards constructed and arranged as above specified; the form of the hive being as set forth."

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4. For an improvement in *Blacksmiths' Forges;* Frederick A. Stewart, Catharine, Chemung county, New York, July 1.

The hearth of the forge is made to slide up and down in a sink, or well, provided with an aperture at the bottom for the removal of the cinder, &c., when the sink has been filled up.

Claim.—"What I claim as my invention, is causing the fire, cinders, and dirt to descend into a well in the bed of the forge, when fresh coal is to be supplied, without disturbing the fire, and accumulating the cinder and dirt on the hearth as in the common forge, the cinder and dirt being removed from said well through an aperture, or opening, at the bottom thereof; and this principle I claim whether it be effected in the manner set forth, or in any other mode in which analogous means are used."

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5. For improvements in machinery for making *Barrels and Casks;* Isaac Crossett, East Bennington, Bennington county, Vermont, July 1.

The staves and heading are cut from steamed timber, by means of knives; the cutter for the staves is of a curve equal to the circumference of the barrel, and the bed on which the block rests vibrates on centres instead of the cutter, for the purpose fully expressed in the claim. In the machine for cutting heading, the knife, or cutter, is attached to one lever, and the bed on which the block rests to another, by which means any amount of draw can be given to the cut. And in the machine for trimming, or forming, the heads, the mandril (which holds the head,) is supported in a frame separate from the frame in which the mandril of the cutters work, so that the one can be presented to the other, the frame of the former sliding on that of the latter. There are two sets of cutters, or segments of saws, attached to a face plate, one being attached to, and parallel with, the face, and the other attached to the periphery, and forming segments of a hollow cylinder, so that by presenting the head to these cutters, or saws, at an inclination, and giving it a slow rotary movement, both bevels are formed at one operation, instead of two, as heretofore.

Claim.—"What I claim, is, first, in the heading cutter, attaching the knife and bed each to a lever, so arranged as to cause the knife and bed to move in opposite directions, by means of which arrangement more or less draw can be given to the cutter, as described; second, in the stave cutter the vibratory motion given to the head piece, by which means the labor of feeding the machine is greatly facilitated, inasmuch as the bed is inclined downwards towards the gauge when it is ready to cut, (which makes it feed easily,) and from the knife after the cut; so that the block can be more easily withdrawn to turn it in the machine, or to take off the core; third, in the head machine, the fixing of saws or cutters, in the face and on the periphery of a revolving wheel, to cut complete heads at one operation from pieces presented to it under an angle, as set forth."

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6. For an improvement in *Fire Arms;* William W. Hubbell, Philadelphia, Pennsylvania, July 1.

The patentee says,—"The nature of my invention consists in detaching so much of the breech end of the barrel as will contain the charge, from the main part of the barrel, by having it to flap over to one side of the barrel, on a rod which runs parallel with the barrel, and thus expose itself to receive the charge, after receiving which it is flapped back to discharge the load through the main part of the barrel.

Claim.—"What I claim as my invention is the breech opening and closing on a rod, as a centre, which runs parallel with the main barrel in the operation of firing fire arms."

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7. For an improvement in the *Supply Pipes of Aqueducts;* John H. Thorndike, Boston, Massachusetts, July 1.

The patentee says,—"My improvement consists in adapting a cylindrical shaped filtering vessel to the aqueduct delivering, or supply, pipes, in such a way that the head, or elevation, of the water may be availed of, and the water be made to flow to as great a height, (after passing through the filter,) as it would if said filter were not used."

Claim.—"It should be particularly noted, that by my improved arrangement the water is filtered without obstructing, or checking, its tendency to rise by the force of its head, so that, in fact, the pipe from which the filtered water is drawn, is but a continuation of the aqueduct delivering pipe, the filtering material, or chamber, only intervening, or being inserted between the two. I am aware that water has been filtered heretofore by the force of its head, and, therefore, do not lay claim to any such arrangement. I claim the combination with the three apartments of the filtering apparatus, of the three pipes, in the manner described."

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8. For an improvement in the *Safety Lock;* Marcus R. Stephenson, and Oliver Edwards, Boston, Massachusetts, July 9: the right of Stephenson assigned to E. Holman.

On the 17th of April, 1844, two patents were granted to these persons, for improvements in locks, having the same object in view as in this, and therefore the reader is referred to pages 418 and 419 of the eighth volume, third series, of this journal, for a statement of the object. In this lock the main tumbler, or "lever plate," is adapted to the reception of a secondary lever plate jointed to, and moving with, it longitudinally, but having a vertical play within it, and kept in the required position within the main "lever plate," or tumbler, by means of an interposed spring, so that a projection on the bolt can pass freely through the slots in both, when brought to the required position by the key acting on the main one; but when pressure is applied to the bolt, in attempting to pick the lock, the projection on the bolt presses against the end of the secondary lever, and prevents it from moving with the main lever, or tumber.

The application for this patent was declared to interfere with a patent granted to Robert Newell, on the 14th of June, 1843, (not yet noticed in this journal,) and on a hearing before the Commissioner of Patents, the priority of invention was declared in favor of Stephenson and Edwards, and this patent thereupon granted to them.

Claim.—"We claim the secondary lever plate, in combination with the main lever plate, the same being applied thereto, and operating therewith, as before described."

9. For an improvement in the mode of *Detaching Horses from Carriages;* John Madden, Warren, Trumbull county, Ohio, July 9.

At the back of the whipple-tree there are two "revolving shafts," extending from near the middle to the ends; the ends of these shafts are bent at right angles, and they are so arranged that the outer end of each one, which is flattened for that purpose, covers the end of the pin on the whipple-tree, to prevent the traces from flying off, and to the inner ends a cord is attached to enable the driver to turn the shafts, and thus uncover the ends of the pins, and permit the traces to escape.

Claim.—"What I claim as my invention, is the combination of the revolving shaft, arms, and cam, with the whipple-tree, in the manner and for the purpose described, the whole being constructed and arranged as before specified."

10. For an improved mode of *Hanging Carriage Bodies*; John Reynolds, Newberry, Lycoming county, Pennsylvania, July 9.

Claim.—"I am aware," says the patentee, "that springs have been attached to the bottom of the carriage, and that these have been connected with the frame by means of levers, and, therefore, I do not claim this general arrangement as of my invention; but what I do claim as my invention, and which I desire to secure by letters patent, is combining the springs, which are arranged within the seat of the carriage and the levers, jointed to the body of the carriage, with the cranked shafts, one of which is permitted to rock, and both being so connected and arranged as to admit of being reversed with facility, to hang the body of the carriage high, or low, as described."

11. For an improvement in *Washing Machines;* Oliver B. Wight, Sturbridge, Worcester county, Massachusetts, July 9.

The box containing the clothes slides back and forth on a frame, and is provided with rollers along the bottom, on which rests a cloth fastened to the box at each end; there is a "rocking beater," (the shaft of which has its bearings working in slots in two standards of the main frame) with the bottom cylindrical, with slots projecting from the periphery at such distances apart as to correspond with the spaces between the rollers at the bottom of the box. The clothes to be washed are placed on the cloth, and by rocking the beater they are squeezed in between the rollers as the box vibrates.

Claim.—"What I claim as my invention is the combination of the rocking beater with the flexible bottom ("cloth") rollers and vibrating box, arranged and operated in the manner and for the purpose set forth."

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12. For improvements in the *Cooking Stove;* James Wager, Troy, Renssalaer county, New York, July 9.

Claim.—"What I claim as my invention, is the manner in which I have combined my fire place with the other parts of the stove, by placing it on the rear side thereof, in direct contact with the back flue, in the manner and for the purpose set forth. I claim also the connecting of the space, or depression, in the sunk hearth, with the fore end of the fire chamber, by means of the cavity, as described, and substantially in the manner and for the purpose made known."

"By placing the fire chamber," says the patentee, "against the back flue, the air within that flue is rarefied immediately on the lighting of the fire, and a perfect draught through all the flues is thereby rendered certain." From the hollow hearth, made in the usual manner, a hollow cavity extends up to the fore end of the fire chamber.

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13. For improvements in the *Cooking Stove,* known as Isaac B. Bucklin's *Railway-Cooking Stove;* John B. Chollar and Horner Parmelee, West Troy, New York, July 13: assigned to John B. Chollar, Eben Jones, and Peter Law.

Claim.—"We do not claim any of the above described different parts separately, nor do we claim any part of the railway cooking stove as patented by Isaac B. Bucklin, or other stoves with movable grates, or fire chambers, as our invention; what we do claim, therefore, and desire to secure by letters patent, is the arrangement and combination of the aforenamed several parts, as follows:—The arrangement of the flues, or openings, in front and rear in the bottom below the oven plate, and in combination therewith the self-acting dampers, constructed and arranged as described, so as to enable us to do away with the sliding plate with boiler holes, as in Bucklin's patent, with his alternating openings on the top of the fire chamber, and substituting in its place our improved fire chamber top with its plates and rings, as described, with two openings, or flues, on the back end. We further claim the combination of the vertical front, rear, and horizontal flues, with their dampers in the fire chamber. We expressly say and wish it to be understood, that we do not claim any of these above described parts as new, but only in the combination described, with Isaac B. Bucklin's patent railway cooking stove, or any other stove of similar construction; that is, with a movable fire chamber, or furnace, moving to and fro under an oven, and as such we claim the invention, adaptation, and combination above named."

14. For an improvement in *Elastic Boot and Shoe Shanks;* Isaiah Gale, Natchez, Mississippi, July 11.

This is for an alleged improvement in springs put between the outer and inner soles of boots and shoes for the support of the instep. Prior to this a single steel plate was used, extending from the heel to the ball of the foot; but the present patent is for the employment of two plates overlapping nearly their whole length, one of them being attached at the heel, and the other at the ball of the foot, the other end of each one being provided with a pin working in a slot in the other, as in elliptical carriage springs, to give them free play in bending.

Claim.—"I do not claim the double elliptical spring, but what I do claim is the combination of the above described spring with the boot, or shoe, in the manner and for the purpose described."

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15. For an improvement in the *Cylinder Mill for Grinding Grain;* Jacob Groat, Troy, Renssalaer county, New York, July 11.

This improvement consists in the manner of setting the grinding surfaces of a cylinder mill, by rotating the concave about an imaginary centre not coincident with the centre of the grinding cylinder, instead of effecting this by moving the concave directly towards, or from, the cylinder, by means of which a concave can be employed extending around full, or more than, half the circumference of the cylinder.

Claim.—"What I claim as new, is the method of adjusting the case, or concave, by rotating it around the cylinder, as described, by means of the grooves, ways, and adjusting screws, in the manner and for the purpose set forth, or by any other means substantially the same."

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16. For improvements in the machine for *Hulling and Pearling Rice, &c.;* Jacob Groat, Troy, Renssalaer county, New York, July 11.

The machine which we have here, like many of the same class, consists of a reservoir and concave, or surrounding case, somewhat conical, and their rubbing surfaces are composed as fully expressed in the following—

Claim.—"What I claim as my invention is, first, constructing the revolving cone in the manner described, with alternate staves of brushes, and gum elastic, and iron, or gum elastic and iron alone, combined and operating in the manner and for the purpose set forth; secondly, I claim, in combination with the above revolving cone, a case formed of triangular shaped files, as above fully made known; thirdly, I claim the method of combining the files with the upper and lower rings, so as to be adjustable, in the manner described, by inserting them in a groove with soft pieces of metal between them, by means of which they may be driven closer together, or separated, as occasion requires."

17. For an improvement in the mode of *Regulating the Supply of Water in Steam Boilers*; John Cochrane, Newark, New Jersey, July 13.

The patentee says,—"The nature of my invention is such that it is necessary for the pump attached to the engine to be of sufficient size to meet the expenditure of water in the boiler from evaporation, and other causes, and that it be allowed to work its full capacity; the apparatus being capable, without manual assistance, of applying so much of this water as may be required to the replenishment of the boiler, and of returning the remainder back again to the pump without loss of power, or heat."

The apparatus consists of a vessel communicating with the boiler, by means of two pipes, one above and the other below the water line, and with the supply pump, by means of a third pipe; the passage to the third pipe is provided with a check valve, the upper end of the stem of which has a float that keeps it open as long as the water is at a sufficient elevation, but which permits it to close when the water sinks to the low water mark. When the water is sufficiently high, and the valve, therefore, open, all the water that is forced in by the pump follows the piston back, and runs out, but when there is a deficiency of water, and the valve is permitted to rest on its seat by the float, the water forced in does not run back until the required supply has been obtained. On the same stem with the check valve, and above it, there is another valve which commands the passage leading from this vessel to the boiler below the water line, so that when the water is sufficiently high in the boiler the float keeps this valve up against its seat, and thus prevents the surplus water from being forced into the boiler. To insure the buoyancy of the float, in case of a leak, the inside of it communicates with the pump through the valve stem, which is hollow for that purpose, and provided with a valve opening outwards, so that the downward stroke of the pump will exhaust it.

Claim.—"What I claim, is, first, the manner in which I have connected and combined the float and the check valve with the force pump, and with the boiler, as herein described, so as to allow any excess of water from the pump to return back thereto by the opening of the check valve under the action of the float; secondly, the connecting of the second valve, placed in the pipe, or opening, through which the water passes from the chamber to the boiler, with the check valve and float, so that both may be operated on by the float, for the purpose and in the manner described; thirdly, the connecting of the float internally with the pump that supplies the boiler by means of a hollow stem and valve, in combination with the check valve, so that the float may be exhausted at each stroke of the pump, and thereby be made to discharge any water that may have leaked into it."

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18. For an improvement in the *Crimp for Crimping Leather for Horse Collars;* Joseph H. Barkdull, Ballston, Saratoga county, New York, July 13.

This crimp is composed of three parts, designated in the claim by the letters *a*, *b*, and *c*, hinged together; and each part is divided in two along the middle, and connected by hinges in such manner that this middle joint of all the parts is in the same line; the hinges that connect parts *a* and *c*, with *b*, are situated at the junction of the two halves of the parts, and the axes of these hinges are at right angles with the axes of the hinges that unite the halves of the three parts, or sections, before the stretching operation is commenced, but after that the angle varies. The connected ends of the parts, or sections, *a*, *b*, *c*, are beveled from the hinges outwards, and the middle section *b*, is provided with curved tongues that fit and slide in mortises in sections *a* and *c*. The leather to be stretched, or crimped, is laid on that face of the instrument opposite the hinges, (which is a little rounding,) and is fastened to the outer edges by pins projecting therefrom, and then the parts, or sections, are turned on the connecting hinges, which enlarges and gives a curve in all directions to that face on which the leather is placed, which thus receives the required swell and curve; the whole is held together at the end of the operation by catches attached to the section, or part, *b*, and that take in notches in the other sections.

Claim.—"What I claim is the combination and arrangement of the parts *a*, *b*, and *c*, constructed and arranged substantially in the manner set forth."

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19. For an improvement in *Buckles;* Henry Lawrence, Manlius, Onondaga county, New York, July 13.

The improvement in question is for dispensing with the tongue, and holding the tug, or strap, by pressure instead thereof. The front end of the buckle is adapted and jointed to a lever, to one arm of which one of the straps is attached, the other strap, or the tug, which is to be fastened, being passed between the other arm of the lever and the plate, or main part, of the buckle, and then through a loop at the other end. From the above it will be evident that a pull on the straps forces one of the arms towards the plate of the buckle, and grips the strap, or tug, with a force proportioned to the force of the pull.

Claim.—"What I claim is the construction of the back piece and the front piece of the buckle, and the combination of the same on the lever principle, as described, causing the said front piece to be pressed firmly against the tug, or strap, so as to hold the same securely, and thus dispense with the common buckle tongue."

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20. For an improvement in the *Grain Separator, to be combined with a threshing, or winnowing, machine;* Jacob V. A. Wemple, of Mohawk, New York, and George Westinghouse, of Schoharie, New York, July 13.

The grain with the straw, if from a threshing machine, or with the chaff, if from a winnowing machine, is discharged on to the separator, consisting of separate sections, each composed of a sheet of wire gauze, surrounded with strips of wood, to prevent the grain from falling out, and all connected together and formed into an endless chain passing over rollers by means of endless belts of leather.

Claim.—"What we claim as our invention, is the separator, as described, that is to say, a revolving screen, or separator, composed of separate portions, or sections, of wire gauze, constructed and secured by endless belts, in the manner described."

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21. For an improvement in the *Bee Palace;* Lemon Hamlin, Kirkersville, Licking county, Ohio, July 13.

Claim.—"What I claim as my invention, is the manner of ventilating the hives, by arranging them around a central vertical opening in the palace; the back of each hive being covered by wire gauze, and in combination with this arrangement, the moth trap placed at the top and bottom of said central opening, the construction and arrangement being as described."

The moth traps are placed at top and bottom of the central opening, the one at the top consisting simply of a circular case with a wire gauze bottom resting on the top of the central opening, and apertures in the case for the admission of the miller; and the one at the bottom is square with a wire gauze cap, which admits air to the central opening of the palace, and side openings, some provided with a gauze shutter, and the others with conical tubes extending in some distance, the smaller ends being within, to prevent the escape of the moth.

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22. For improvements in the *Washing Machine;* William E. Arnold, Rochester, Monroe county, New York, July 13.

The improvements claimed under this patent, are applied to that kind of washing machines in which the clothes are washed by means of a swinging beater, or dash-board, perforated for the passage of water. The first improvement consists simply in giving an inclination to this dash-board, or beater, and hinging it by the lower edge, and so connecting it at top with the swing frame that the inclination can be varied at pleasure. The object is to throw up the clothes, which are then forced back, and turned by a reciprocating wedge, that has a movement up and down by being connected with arms that project out from the top of the swinging frame, so that as the dash-board advances towards the wedge, it rises, and descends as the dash-board is moved back.

Claim.—"What I claim therein as new, is, first, the varying of the inclination of the dasher-board, in the manner and for the purpose described; I likewise claim the application and use of the reciprocating wedge, constructed and operating as set forth."

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23. For an improvement in the machine for *Crimping Leather for Boots;* Pelatiah Stevens, jr., Canton, Norfolk county, Massachusetts, July 15.

Claim.—"I claim the described arrangement of the clamping plates and clamps, so as to extend entirely around, or in opposition with the lower edges of the boot former, and have a space between the clamp plates to receive and permit the depression of the boot former below, and its elevation above, their upper edges, in the manner set forth, the said improved arrangement of the parts enabling the attendant to stretch and shape the leather more thoroughly, conveniently and expeditiously, than by others heretofore used; and I also claim the wrinkle preventer, as applied to, or combined with, the boot former, and constructed and used substantially in the manner set forth."

The former slides up and down between the clamp plates, by means of a screw, and the edges of the leather are secured to the clamp plates by a series of clamps jointed to the plates; and the wrinkle preventer consists of a plate of metal bent in the form of a U, with the edges so curved as to correspond in form with the instep of the boot, and so connected, by means of a lever, with the frame of the machine, as to enable the operator to apply the curved edges to the leather, and prevent any tendency to wrinkle during the crimping operation.

24. For an improvement in *Setting Logs on Saw Mill Carriages;* Francis M. Stetson, of Sangerfield, and John Eaton, of Brookfield, New York, July 15.

The slides on the head and tail blocks of the carriage to which the dogs are attached, are moved by means of screws, in a manner well known to those who are acquainted with saw mills; and for the purpose of operating the two screws simultaneously, they are connected by bevel cog-wheels, and a shaft extending from the head to the tail block, and parallel with, and at the side of, the carriage; the bevel cog-wheel on one end of the shaft being adapted to the shaft by a feather, or square socket, and connected with the tail block by a collar, so that the tail block can be moved towards, or from, the head block.

Claim.—"What we claim as our invention, is the connecting together the screws and sliding blocks on the head and tail blocks of the carriage, so as to move both ends of the log simultaneously and equally, and at the same time allowing the head blocks to recede from, or approach to, the foot block, and thus be adjusted to the length of the log to be sawed, the whole being arranged, combined, and connected substantially as set forth and described."

25. For an improvement in the *Ice Breaker* for boats and other vessels; Samuel Nicolson, Boston, Massachusetts, July 16.

The bow of the boat is to be provided with ice cutters, or breakers, attached to a rotating shaft actuated by a steam engine, or with permanent cutters moving with the boat; these instruments cut the ice, forward of the boat, into strips, which are broken off and forced under the surface of the water by an inclined shield attached to the bow of the boat, provided with two projecting inclined surfaces that run obliquely from the middle of the forward end to the sides, to force the broken under the unbroken ice beyond the paddle-wheels of the boat, and thus clear the channel.

Claim.—"What I claim as my invention, is making the shield, or shoe, at the bow to consist of a combination of inclined surfaces, arranged as herein described, so as to depress and carry the ice under, and on each side, the shield being as wide, or nearly so, as the extreme width across the paddle-wheels by which the boat is propelled."

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26. For improvements in *Saw Mills;* Henry Stanton, Richfield, Otsego county, New York, July 16.

These improvements are for the purpose of more effectually steadying the log whilst under the action of the saw. The first improvement consists of a bar extending from the slide of the head to the tail block, attached permanently to one, and so connected with the other as to admit of changing the distance between the head and tail blocks for different lengths of logs. Towards the middle of the length of this bar there is a bail and sliding dog, by means of which the middle of the log can be dogged to steady it; and the other improvement consists simply of a metallic plate attached to, and projecting above, the rebate of the head and tail blocks to fit into grooves cut across both ends of the log, to prevent it from slipping endwise.

Claim.—"What I claim is, first, the arrangement of the longitudinal bar and dogs attached to the ends of the slides of the head and tail blocks for supporting the log at the middle, in the manner described; second, the arrangement of the vertical plates on the head and tail blocks, for entering notches made in the under side of the log, to prevent it having any movement longitudinally whilst being sawed, as described."

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27. For an improvement in the *Bench Vice;* Lauren M. Peck, Philadelphia, Pennsylvania, July 18.

The patentee says,—"The object of my improvement is the so constructing of a vice that the jaws thereof shall adapt themselves to articles of unequal thickness, such, for example, as are tapering, or wedge-formed, and which cannot, therefore, be securely held in those of the ordinary construction. This end I attain by allowing one of the jaws, most commonly the front, or movable, jaw, to turn in a socket, like the T of a lathe rest, or otherwise to swivel on a joint, or pin, so that it may move to the requisite distance; and to admit of its so doing, I furnish the screw with a ball and socket joint, where it bears against the movable jaw; or, instead of this, I allow the screw head, or rather a washer, under it, to bear upon two projecting pieces of hardened steel on the fore side of the jaw of the vice, said two projecting pieces being in a vertical line with each other."

Claim.—"What I claim is the causing of one of the jaws of a vice, and that usually the front jaw, to swivel, or turn, in a socket, or on a gudgeon, or joint pin, for the purpose of enabling it to embrace an article firmly which may be tapering, or of unequal size at its two ends; the same being effected on the principle, or substantially in the manner, herein set forth."

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28. For an improvement in the *Grate Bars of Furnaces;* John Kymer, Great Britain, July 19.

Claim.—"I do hereby declare that I do not make claim to the causing of steam to enter the furnace in conjunction with atmospheric air, by which the combustion is to be kept up; this having been previously done by conducting waste steam through tubes arranged beneath the grate bars, such steam having been allowed to escape through lateral perforations made in said tubes for that purpose; but what I do claim is the manner described of protecting the fire bars from being burnt out, and of generating steam to aid in the combustion of the fuel, by causing the grate bars to dip into troughs which are kept supplied with water, said bars and troughs being combined and arranged substantially in the manner and for the purpose set forth."

The grate bars are represented as quadrangular, with one of the angles dipping into troughs, arranged parallel with each other, and all connected together at the ends, there being sufficient space between the troughs, equal to the space between the bars, for the admission of atmospheric air.

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29. For an improvement on the machine for *Sewing with the running stitch;* James Rogers, New York City, July 20.

This is for an improvement on a machine patented to Benjamin W. Bean, on the 4th of March, 1843. There is a main cog-wheel designated in the claim by the letter A, which gears in a small wheel B, that gears in another wheel C, and this last one gears into another D, directly above it; the teeth, or cogs, of these wheels are made pretty much in the same form as the teeth of a crimping machine, and the piece of cloth to be sewed, in passing between these wheels, is crimped, and in its passage the crimps are carried on to a needle which lies in a groove cut in the circumference of the wheels, and so curved as to lie between the wheels D, C; it is then curved down around one quarter of the circumference of the wheel C, where it gears with wheel B, then around wheel B, where it gears with wheel A, and extends for a short distance on the periphery of this latter one, the point lying between it and another wheel F, similar to B, but a short distance from it.

Claim.—"I hereby disclaim the original invention of sewing cloth by machinery with a running stitch, but what I do claim is the arrangement of the wheels A, B, C, and D, in combination with the needle having but two bends which allows the machine to work much better, being more simple in its construction, and thereby having five wheels less than the original machine."

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30. For a process for *Renovating Tobacco after it has become mouldy;* Enoch Huse, Newburyport, Essex county, Massachusetts, July 22.

This process consists "in immersing, or soaking, the package of tobacco in water for five minutes, or upwards, as circumstances may require; and as the tobacco is usually packed in boxes, or kegs, these are generally introduced, filled with damaged tobacco, into the vat of water. This being accomplished, and the water having penetrated the tobacco to the necessary degree, which a little practice will soon enable a workman to determine, the tobacco is next removed from the vat, and put into an oven, or drying room, and there subjected to such a heat as may be necessary to entirely, or nearly, dissipate the water, and destroy the mould; the said heat varying, according to circumstances, from one hundred degrees of Fahrenheit, to such a heat as the article will bear without scorching, or burning, to an injurious degree. In order to produce this heat any of the known modes may be adopted; the article is then subjected to powerful pressure, in the same manner as tobacco is usually pressed into boxes, or kegs, for the merchants, or market.

Claim.—"I claim the said process substantially as described."

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31. For an improvement in *Washing Ores;* Nicholas Troughton, Swansea, England, July 22.

Heretofore ores in the process of washing for separating the metallic particles from the refuse matter, have been subjected either to a vertical, or a horizontal, current of water; but by this improved process they are subjected to the two currents at the same time, by which the drop, or lighter, matter is more effectually separated from heavier metallic particles. The apparatus described for applying this process consists of a series of sieves separated by partitions, and surrounded by a casing with a valve opening upwards, and placed at one end of the series; the ground, or pulverized, ore is placed in the sieve next to the valve, and the whole receives a vertical reciprocating movement in a vessel of water. On the descent of the sieves a current of water passes through the meshes of the sieves and the valve, the former in a vertical direction, carrying up the ore, and, of course, the drop, or lighter, matter higher than the metal, and the latter taking a horizontal direction after passing the valve, in consequence of its volume, and carrying the drop with some of the metallic particles to the next sieve, and so on through the series.

Claim.—"What I claim consists in separating the ore from the refuse matter, &c., by subjecting the whole to the action of vertical, or nearly vertical, and horizontal, or nearly horizontal, currents of water in combination, whether these currents, or either of them, be produced in the manner herein described, or by any other, suitable for the purpose. I also claim the combining with the series of sieves a casing, extending around, or partially around, the series, as set forth, and a valve, or valves, arranged, with respect to the series, as described, or in any other manner, so as to produce the intended effect, so that when the whole is placed in a tank of water the upward and onward currents required for the process of separation, above described, may be obtained by simply causing the series of sieves to move up and down, or, in other respects, as specified."

32. For combining a *Fire Fender with And-Irons;* Morgan Morgan, jr., New York City, July 22.

The fender is connected with the pedestals of the and-irons by means of hinges constructed in any known manner of making separable hinge joints.

Claim.—"What I claim is a new mode of applying a fender to and-irons by the means of joints, hinges, slides, and hanging upon the bars, so that the and-irons may be movable."

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33. For improvements in the *Apparatus for supplying Boilers with Water, and for improvements in the Steam Engine;* Daniel Barnum, Bridgeport, Fairfield county, Connecticut, July 24.

At page 248 of vol. xxvi, 2d series, of this Journal, will be found a notice of a patent granted for combining an auxiliary rotary engine with the boiler and supply pumps, by means of a float and valve within the boiler, in such manner that the descent of the water shall open the valve and admit steam to start the engine, and thus supply water. Under the present patent a reciprocating engine is employed for the purpose of working the supply pump, when the descent of the float in the boiler opens the valve that admits steam to it, and for this purpose the valves are so arranged that the admission of steam will start the engine in any position in which the piston may have stopped. The piston rod of the engine is provided with an arm, the outer end of which embraces and slides on a cylindrical rod attached to a crank arm on the rock shaft of the slide valves for the purpose of operating them, there being a stop at each end of the rod, with a spring interposed to ease the blow when struck by the arm on the piston rod, and insure the complete shifting of the valves, although the stroke of the piston may not be complete. As a guide and regulator of the operation of the valves, there is an arm projecting from the rock shaft of the valves, the end of which works against (first under and then over,) a guide plate attached to the arm that projects from the piston rod, and which, therefore, moves with it; for the guide plate is substituted a plate with a curved groove, which receives and guides the arm of the rock shaft, the groove being so formed as to close the valve at any point required, and thus answer the purpose of a cut-off. The piston rod of this auxiliary engine is attached to the piston of a pump, which, by an arrangement of pipes and cocks, can be used either to supply the boiler, or to extinguish fires. The float within the boiler is placed in a case provided with a pipe that passes through the boiler for the purpose of blowing off the contents of the float case, or box, independent of the boiler.

Claim.—"What I claim as new, is, first, the within arrangement for blowing off the contents of the box, by means of the pipe, independently of blowing off the general contents of the boiler; I claim the manner in which I have combined and arranged the small auxiliary steam engine, the fire engine, with the supply pump, by which the action of the slide valve is regulated, and the water supplied to the boiler; I claim the peculiar manner of regulating the cut-off of a steam cylinder herein described, whether applied to the small auxiliary engine for filling the boiler, or to any other steam cylinder to which it may be adapted: I claim the manner in which I have combined the double valve, with the float and the auxiliary engine, for the purpose of insuring its ready action in the boilers of high pressure engines. I do not claim to be the first to have used two valves upon one stem, this having been done before in what is called the balance valve; but I do claim the special arrangement of the double valve, in the combination, and for the purpose described." [The object is to balance the valve, that the float may operate independent of the pressure of steam within the boiler.] "And I do hereby declare," says the patentee, "that I do not claim to be the inventor of the application of an auxiliary engine made to operate by the agency of a float, so as to set in motion a supply pump for the supplying of a boiler, a method of doing this having been described by Isaac N. Coffin, and patented by him on the 13th day of September, 1839; but I limit my claims, as above specified, to the arrangement and combination of the respective parts of the apparatus, as made known; nor do I claim the using of a box to inclose the float, excepting when this is done both at top and bottom, and in combination with a tube, by means of which arrangement the float is guarded against the effects of foaming: and I do hereby further declare that I do not intend to limit myself to the precise form and arrangement of the apparatus, as described, but design to vary the same as I may find expedient, whilst I attain the same ends by means substantially the same. I have, for example, now in operation on board the steamboat 'Croton,' on Long Island Sound, an apparatus constructed by me, and substantially the same with that described, but instead of the single steam cylinder of the auxiliary engine, I have used two cylinders, the piston rods of which are attached to a three throw crank shaft; two of the cranks having the two steam piston rods attached to them, and the third working the supply pump, an arrangement that will probably be preferred, as operating more steadily than the single cylinder engine."

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34. For improvements in the *Auxiliary Steam Engine for Supplying Steam Boilers;* Henry R. Worthington, New York City, July 24.

As the general principle of this apparatus is like the preceding, it is only necessary to say, that the arm which projects from, and is carried by, the piston rod for operating the valves, is attached to and carries the cylindrical rod, to which are attached tappets that act on the lower end of a trip lever, the upper end of which embraces the lever, or arm, of the slide valves; the lower end of the trip lever is provided with a roller that acts on a wedge piece kept up by a spring, so that the moment the roller has been forced over the angle of the wedge piece, the tension of the spring forces it entirely over, by which the complete action of the valves is insured, notwithstanding the engine may not complete its stroke.

Claim.—"What I claim as new, is the manner in which I govern the action of the slide valve of the auxiliary engine, by the aid of the tappets, the vibrating piece, (trip lever) the sliding (wedge) piece, and their appendages, as set forth; I claim the so regulating of this action, whether the apparatus be constructed precisely in the form represented, or in any other in which a like effect is produced, by means substantially the same."

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35. For an improvement in the mode of *Setting Logs on the Carriage of a Saw-Mill;* Waterman B. Palmer, Brookfield, Madison county, New York, July 24.

For the general principle of the mode of setting logs, described in the specification of this patent, the reader is referred to the notice given of a patent granted to Henry Stanton, on the 16th of this month, (July,) number 26 of this list, the present patent having been granted for a combination and arrangement of parts for operating the long shaft that forms the connexion between the slides on the head and tail blocks. The claim refers to and is wholly dependent on the drawings, and therefore we are under the necessity of omitting it.

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36. For an improvement in the *Paddle-Wheels of Steamboats, &c.;* Richard D. Chatterton, Derby, Great Britain, July 24: to run fourteen years from the 11th of January, 1842, the date of the British patent.

This is for an alleged improvement on that kind of side paddle wheels in which the paddles, or floats, are placed at an angle with the shaft, as fully explained in the following—

Claim.—"I declare that what I claim as of my invention in paddle wheels of steamboats, and all other vessels, machines, or bodies which are propelled, or moved, by the action of floats, or other like contrivances, in and against water, in oblique positions relatively to the shafts, or axes, and in series of pairs in oblique directions the reverse of one another; is the placing of the inner extremity of each of the individual paddles, or floats, so as to project beyond the inner termination of the one opposite thereto, and said inner extremities being at such distances from each other as to admit of the passage of water between them. I do not claim the use of pairs of floats, or paddles, inclined towards each other, when such pairs meet and form an angular point, this having been often done; but I limit my claim to the particular arrangement of such pairs of floats, or paddles, as herein set forth, but without confining myself to the precise angles, or relative distances at which the floats are represented to be fixed, and reserving to myself a right to place them at any more suitable angles, or distances, by which the like beneficial results may be obtained."

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37. For an improvement in the *Bolter for Flouring Mills;* Ryburn Buchanan, Sullivan county, Tennessee, July 24.

Claim.—"What I claim as my invention, is the combination with the bolting reel of the long, vibrating, re-acting knocker, or knockers, suspended within the reel, and acting, when in operation, upon the arms of the same from one side to the other of the same, and reacting when revolved to the opposite side, so as to keep the bolting cloth clear of dust, as described, without injury to the cloth, and preventing its slipping on the ribs of the bolter."

38. For improvements in machinery for making *Wrought-Iron Spikes, or Nails ;* S. G. Reynolds, of Bristol, Rhode Island, now residing in Cecil street, Strand, Westminster, England, July 26.

The claims under this patent refer throughout to, and are wholly dependent upon, the drawings, which are very numerous, and we are, therefore, under the necessity of omitting them.

The nails, or spikes, are made in this machine by cutting from a plate, instead of a rod, as heretofore; the piece after being cut off from the plate, is griped and held against the die, by which it was severed from the plate, which becomes the bed against which it is rolled into the required form by a roller. After the operations of cutting and rolling, the head is struck, and the point formed by appropriate dies.

39. For a machine for *Trimming the Blanks in the manufacture of Butt Hinges ;* Cyrus Kenney, Troy, Renssalaer county, New York, July 26.

"The butt hinges that are to be manufactured by the aid of my machine, are such as are formed from wrought-iron, or other malleable metal. In the manufacture of such hinges the flaps, or halves, of the hinge are first cut out of rolled, or sheet, metal, with the pieces projecting from one side thereof, which, when bent, are to form the knuckles of the hinges, this cutting being effected in a manner well known. In the process of bending the knuckles formed from the projecting pieces, these become elongated, so that the two sides, or halves, of the hinge will not come together until reduced to the width they had before being bent. The machine covered by this is intended to remove this difficulty by cutting, or trimming, off a small portion from the sides of the projecting pieces, before they are bent, and made into knuckles." For this purpose there are gauges that fit between the projecting pieces before being trimmed, attached to the under part of the trimming cutters, or dies, operated by a lever, and acting against bed dies which aid in shearing off the surplus metal. The dies and gauges are regulated by set screws.

Claim.—"What I claim is the manner of arranging and combining the dies and gauges substantially as described and set forth in the specification."

40. For improvements in machinery for making *Barrels, Firkins, &c.;* Horace Baker, McLean, Tompkins county, N. York, July 30.

After the staves have been shaved in the usual way, they are clamped in a curved bed attached to a swinging frame, the centre of vibration of which corresponds with the centre of the barrel, and by means of this swinging frame they are presented, first, to a circular saw, which cuts off the surplus wood, and then to a straight reciprocating jointer. After this operation all the staves for a barrel are put together between two circular plates, on a lathe, with teeth for holding them firmly, and then turned off by means of cutters attached to a stock which slides transversely on a carriage that moves from end to end on ways; the stock being so arranged as to embrace a guide of a curve corresponding with the bilge of the barrel.

Claim.—"What I claim is the employment of the swing frame constructed and arranged as described, in combination with the edging and jointing machines, in the manner and for the purpose specified. I also claim the method of holding the staves for turning, in combination with the movable, double-motion, cutter carriage, arranged and constructed as before specified."

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41. For an improvement in the *Silk Reel for Reeling Silk;* James S. Harris, Poultney, Rutland county, Vermont, July 30.

"To prevent any injury to the silk upon the reel by undue tension, and to facilitate the removal of the silk from the reel," one arm is connected with the hub by a spring and slide.

Claim.—"What I claim is the spring graduated by the screw, in combination with the sliding arm of the reel, constructed and operating as described."

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42. For an improvement in the manner of *Constructing large Wrought-Iron Cannon;* Richard F. Loper, Philadelphia, Pennsylvania, July 30.

Claim.—"I am aware that it has been proposed to make large guns of staves and hoops, but not like those constructed by me. I do not, therefore, claim simply making guns of hoops, or rings, and staves, but what I do claim as my invention, and desire to secure by letters patent, is making guns by uniting the rings of each layer by screwing them into each other, and also by screwing other layers, or tiers, on to the first, second, third, and so on to any extent, as described."

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43. For improvements in *Fire Arms;* Edward Savage, and Simeon North, Middletown, Middlesex county, Connecticut, July 30.

This is for an alleged improvement in the mode of constructing guns, &c., that load at the breech, by making the breech part of the barrel separate and movable, the back part of this section turning on a joint pin in a socket, that the forward part may be thrown up sufficiently to receive the charge, and consists in a mode of insuring the coincidence of the movable section with the permanent part of the barrel, after being charged, and an arrangement of parts for giving the requisite movements. On each side of the movable section there is a strap, one of which is cut out to receive a shoulder, (called in the specification a permanent chock,) on the side of the movable section, and the other adapted to receive the joint pin, or spindle, of a tumbler that embraces a circular projection on the other side of the movable breech, so that by the turning of this tumbler it is thrown up, or down; the spindle of the tumbler being provided with a hand lever, one end of which is cam-formed, and acted upon by a spring, to insure the complete movement of the parts.

Claim.—"What we claim is the combination of the tumbler chock with the receiver, (breech) in the manner and for the purpose set forth. We also claim, in combination therewith, the permanent chock, constructed and arranged as set forth. We also claim the lever and spring, in combination with the tumbler, chock, and receiver, arranged substantially in the manner and for the purpose described."

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44. For a *Rotary Printing Press;* Richard M. Hoe, New York City, July 30.

We make the following extract from the specification, viz.,—"The distinguishing feature of this press, is its being provided with a number of cylinders, say from two to six, or eight, or more, each of which is to receive a sheet of paper that is to be carried by it to the form of types to receive an impression. The whole of these cylinders are to be carried round, by the continuous motion, in one direction, of an axis which is their common centre of motion; or the cylinders may be attached to one or two chains, or bands, in a manner similar to that of the inking rollers, the form of type remaining at rest during the whole operation, so that the reciprocating action of the platen, or bed, or any other part having considerable momentum, is avoided." The journals of the cylinders are so arranged and connected with this common central axis as to slide towards and from it, and have a horizontal movement in passing over the form of type, and give the required impression. The practical application of this general principle, with the adaptation of all the details necessary to the operation of printing, is fully described and represented in the specification and drawings, and claim is made to the general character stated above, and to many of the details, but as the claim refers to the drawings, the publication of which would carry us beyond the limits of this work, we are under the necessity of omitting them; the reader will, however, from the above, be able to form a pretty clear notion of this novel and ingenious device.

Improvements added to existing Letters Patent during the month of July, 1844.

1. For improvements in *Boxes for Railroad Carriages;* John H. Tims, Newark, New Jersey, July 1.

This is for an improvement added to letters patent granted to Mr. Tims on the 31st of October, 1839, and noticed in 2d series of this Journal, vol. xxvi, page 394, to which the reader is referred.

Claim.—"What I claim is the employment of two caps, or washers, provided with packing between them, in combination with the grooved ring, by which arrangement the dust is effectually kept out of the oil box, and the oil kept in, as described, and this I claim as an improvement on the method employed by me heretofore, and secured to me by letters patent, and consisting of a single washer and grooves on the axle."

Patents for Designs which issued in the month of July, 1844, *under the third section of the Act of August* 29, 1842.

For *Ornaments to be cast, or stamped, upon iron, or other plates, used in the construction of Stoves;* Amaziah Whitney, Albany, New York, July 19.

MECHANICS, PHYSICS, AND CHEMISTRY.

Notice of the Manufacture of Glass in Bohemia. By M. L. P. Debette.—[Annales des Mines, 4th series, volume iv, page 553; December, 1843.]

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

(Continued from Page 122.)

Chapter IV.—*Manufacture of Table Glass and Fine Glass.*

As soon as the glass of the preceding casting has been worked up, each crucible is charged with about 154 lbs. of materials previously fritted, taking care to put the arsenic first, at the bottom of the crucible. This mixture varies, in a very notable degree, in different establishments, as may be seen from the following table:

	1	2	3	4	5	6	7	8	9
Pulverized quartz,	110	100	80	60	120	100	120	120	100
Superfine calcined potash,						30	60	70	55
Fine " "	64		28		60				
Common " "				60					
Carbonate of potassa,		75							
Caustic lime,	24	50	18	24	25	18		10	
Carbonate of lime,							24		8
Arsenious acid,			$\frac{1}{4}$	2	$\frac{1}{2}$			$\frac{1}{2}$	
Peroxide of manganese,			$\frac{1}{4}$		2		$\frac{1}{16}$	$\frac{1}{5}$	$\frac{1}{4}$
Nitre,			$\frac{1}{4}$		2		2	1	
Old glass broken and sifted,									50

(1) White table glass, first quality, from Schwarzthal, a little white arsenic, and a very little peroxide of manganese are added.

(2) White table glass, from Neuwelt, (M. Perdonnet,) a small quantity of nitre, oxide of manganese, and white arsenic are added.

(3) Very white table glass (M. Penhok.)

(4) Common table glass (M. Hermbstädt.)

(6) (7) (8) (9) Fine glass, called Bohemian crystal, from various establishments. To (6) (7) and (9) a little white arsenic is added.

As soon as the glass pots are charged, the fire is increased by putting a very little more wood frequently upon the grate; gradually the mixture contained in the glass pots melts, and soon very small bubbles of gas begin to be disengaged from the midst of the fluid mass; the temperature of the furnace is continuously raised, and from time to time the melted mass is stirred with a piece of wood, in order to facilitate the disengagement of the bubbles which gradually augment in size. The workman judges that the fusion is nearly completed when the bubbles are formed but rarely, and of large size. He then ceases to stir the fluid mass, and suffers it to rest for a full hour, the fire being suffered to fall slightly, so that the glass may take sufficient consistency to be worked. The melting is then finished, and the working, properly so called, commences. Each melting pot is then served by a blower, (blaser) and an apprentice, (lehrjunge) as we have already said. The iron tubes which they use are nearly five feet (1.5 metre) long, weigh from 8½ to 11 pounds, and are provided with a handle of wood about 13 inches (33 centim:) long, to assist in the manipulation.

As the working of glass is a thing very difficult to explain, and one which must actually be seen in order to be well understood, I suppose that I may dispense with details upon this subject, feeling certain that in the remarks which I have to make I shall be understood by those who have studied the art of manufacturing glass.

The forms, or moulds, employed are generally made of two pieces, except in very particular cases where extremely simple articles are to be made, such as ordinary drinking glasses, to which a handle is often afterwards added, as in beer glasses, while the glass is still sufficiently soft to weld. These forms are of wood, clay, brass, or copper; those of cast-iron being not yet employed in Bohemia. Those most used are of wood, which the apprentice takes care to moisten very frequently, so as to prolong their duration by preventing them from taking fire.

In these arrangements it will be seen that there is no division of labor, and the same workman begins and finishes the pieces, so that the work is executed rather less rapidly than in France.

In fine, the melting of the glass lasts from 18 to 20 hours, the working, properly so called, from 14 to 15, making in all 32 to 35 hours for the whole operation. The loss by volatilization is from 15 to 20 per cent., and consists of water, carbonic acid, and alkali; there is obtained from 88 to 110 pounds per pot of finished glass, not including the loss, during the manipulation.

The annealing of the glass is performed by placing them, while still hot, in clay crucibles, 6-10ths of an inch in thickness, placed in the annealing furnace annexed to the melting furnace. The interior dimensions of these crucibles are as follows:—

Diameter at the mouth, ...	15.68 inches.
" " bottom, ...	15.68 "
Depth, ...	19.6 "

When one of these crucibles is entirely filled, it is withdrawn by one of the doors of the furnaces, constructed for this purpose, and suffered to cool slowly in a corner of the establishment; the cooling being retarded as much as possible by covering it with a sheet-iron lid.

It may be easily seen how imperfect this process is, when compared with the constant annealing furnaces now in use in France, the use of which has not yet extended to Bohemia.

CHAPTER V.—*Of the Manufacture of Bottle Glass.*

The bottle glass of Bohemia is very slightly colored, and would sell very badly in that country, if it had the deep green, or yellowish green color which our glasses present. In most of the glass establishments they make it by remelting old glass with that which runs out upon the hearth of the furnace when a pot breaks by age, or accident. In some other glass works, such as that of *Gross-Luckawitz*, near *Chrudim*, the bottle glass is made from a very friable quartzoze sandstone, belonging to the *quader sandstein* formation of Bohemia, and sufficiently white for this purpose, from a very calcareous clay, a kind of tertiary marl, very recent, and very often covered with a formation of turf, and from glauber-salts, (sulphate of soda,) the residue from the preparation of nitric acid in the manufactory of chemicals established at the same spot, and belonging to the same proprietor, the Prince Auersperg. There is added besides these a certain quantity of charcoal dust to reduce the sulphate of soda. This establishment possesses but one circular glass furnace, containing six pots, the charge of each of which is about 177 pounds. The working season of this furnace is six months; the respite necessary for the repairs two months, and the blowers are not paid by the piece, as is the usual custom, but receive each one 1032 francs ($206.5) for the working season. They are besides exempt from all rent, or manorial dues, for the small portion of land which is allotted for their use.

The melting of the glass takes place exactly as I have described it in the preceding chapter. Then the blower takes upon the end of his tube a quantity of glass sufficient to form a bottle, by dipping it two or three times in the glass pot, and blows through the tube, which he turns, guiding it by a bar of iron, while the apprentice presses upon the glass a block of wood, which he dips in water from time to time, when he sees it take fire. Near the blower there is placed a tub full of water, from which he takes it from time to time in the hollow of his hand to cool his tube, when he finds it heat too much. When the piece becomes too cold, he reheats it, introducing it into the furnace by the opening which is above the glass pot, then resting his tube upon an iron hook which projects from the embrasure, he gives it a continuous motion of rotation, in order to prevent the glass from bending, or inclining, to either side. As soon as it has acquired nearly the desired form and size, he finishes it by placing it in a wooden mould, formed of two pieces, which is held by the apprentice, turning it, and blowing into it continually. Sometimes, however, a mould of a single piece is used, as is practised almost always in France, but here far more rarely. The bottles have ordinarily their bottoms entirely flat.

As soon as the bottle has taken the desired form, the workman withdraws it from the mould, and his apprentice takes it by the bottom by means of a rod having a drop of melted glass upon it. The workman then detaches it from his tube, and forms the head by applying a cold body, or, in case of necessity, even by letting fall a drop of cold water upon the place which he wishes to cut. It is then slightly reheated by his apprentice, and a glass band wound around the neck to strengthen it. The bottle is then finished, and nothing remains but to transport it to the annealing furnace, which is sometimes joined to the melting furnace, sometimes separated, as at *Gross-Luckawitz*. In the latter case the furnace is kept at a dull red heat for four or five hours after it is full, then all the openings are closed, and it is left to cool spontaneously. To clean his tube, the workman dips it, while yet hot, into cold water, the glass at the end crumbles, and is detached by a single blow of a hammer.

To conclude, in the manufacture of bottle glass the melting lasts from 18 to 20 hours, the working 8 to 10 hours, in all from 26 to 30 hours.

CHAPTER VI.—*Manufacture of Window Glass.*

The mixture employed for making window glass varies so to speak, in each establishment, as may easily be seen from the following table :—

	1	2	3	4
Pulverized quartz,	60	60	60	100
Fine calcined potassa,				50
Common calcined potassa,	40		17	
Common calcined soda,		36	17	
Caustic lime,			6	
Carbonate of lime,	5			80
Debris from working glass,	100	100	120	
Old broken glass,	100	100		
Nitre,				2
Smaltz,				$1\frac{1}{2}$

(1) (2) Common window glass, (M. Penhok.)

(3) White window glass, from Schwarzthal and Paulina, near Gratzen.

(4) Very white window glass, (M. Hermbstädt.)

The melting of the glass offers nothing peculiar to arrest us. As soon as it is ended each blower takes upon the end of his tube a quantity of glass varying with the size and thickness of the sheet which is to be made, and blows it, swinging it in a vertical plane, so as to give it the form of an elevated cylinder terminated at each end by a hemispherical cap; he then gives it the desired dimensions in a wooden mould of one piece. He then separates the farther end by the application of a cold iron, then reheats the piece, swinging it again, at the same time that he gives a rotary motion upon its axis to the pipe, and thus gives it the form of a cylinder, open at one end; he then separates it from his tube by means of a cold iron, or, if necessary, by a drop of cold water; he then cleans his tube, and recommences the same operation. The cylinders thus blown are slit throughout their whole length as soon as they are cool, by means of a red hot rod of iron. They are then introduced into the flattening kiln, (streckofen) by sliding them along two long iron rods, until they rest upon a plate of clay movable upon a railroad. There they are flattened by the heat, as the glass softens, and as soon as they are completely spread upon the plate of clay, these are slid upon the railroad into the annealing furnace, and then as soon as the glass is sufficiently cool to resist bending, the plates are gradually raised and rested upon rods of iron supported in grooves in the sides of the furnace. As soon as the annealing furnace is full, all the openings are closed, and it is suffered to cool slowly.

Fluted Window Glass.—Besides the plain window glass, they make, in Bohemia, a great deal which is fluted, either in one direction, or in two directions, making an angle of 30° or 45° with each other, presenting, in this case, the appearance of small consecutive lozenges. These glasses have the advantage of enabling us to dispense with window blinds and curtains, as they disperse the rays of the sun, so that they cannot produce inconvenience, and prevent any prying eye from looking into the room. The fluting of these glasses is effected during their blowing. For the glasses fluted in one direction only, it is sufficient to employ moulds of a single piece, either of wood, clay, or metals, and fluted in the direction of their length. The only difference in fluting them in two directions consists in the use of a more complicated mould, made of two pieces which are separated, in order to withdraw the cylinder.

Elliptic Shades.—The shades of clocks, &c., which have an elliptic form, are made also by moulding, but as they require a large quantity of air in blowing them, a peculiar process is used, invented in France by a workman in the establishment at Baccharach. This process consists in a hollow cylinder closed at one end, in which is fixed a spiral spring attached to a piston which moves in the cylinder. This is attached to the end of the tube, and the piston being suddenly forced down, all the air contained in the cylinder is driven out through the tube; the shade is then detached from the tube, and the open end finished by cutting.

CHAPTER VII.—*Of some peculiar fabrics of Gluss.*

Manufacture of Glass Tubes with Circular Bores.—To make cylindrical tubes the workman first blows a cylinder, as in the manufacture of window glass, except that he gives it greater thickness, and less internal diameter; then, after reheating it, his apprentice attaches another tube to the free end, by means of a drop of melted glass, and the cylinder is drawn out by their rapidly receding from each other. Nothing is then left except to divide the long tube, thus obtained, into sections, and, to anneal these sections, the diameter and thickness of which depend upon the quantity of glass employed, the ratio of the external and internal diameter of the original cylinder, and the greater, or less extension which it has undergone.

Manufacture of Glass Tubes with flattened Bores.—For some years past capillary tubes, with flattened bores, have been much employed in the construction of mercurial thermometers, on account of their presenting the advantage of tubes, the section of which is very small, compared with that of the reservoir, while, at the same time, the mercurial column is very easily seen, when observed in a direction at right angles to the larger diameter of the section.

To make these, the workman takes upon his tube a certain mass of glass, without blowing it, and forms a sausage-shaped lump, which he presents to his apprentice, who seizes it at the end with a pair of small pincers held in one hand, whilst, with the other, he thrusts into it, in the direction of its length, a kind of double-edged knife, taking care to enlarge the opening, the other lip of which he immediately seizes with another pair of pincers, and draws it out by moving backwards, in a straight line, without turning the glass, as is done in a common tube. One-fourth, or one-eighth, of the tube, thus obtained, is fit for commerce; except that it very frequently happens that the bore is not exactly in the middle of the tube, which, however, is but a slight inconvenience, provided it be not far from it.

Manufacture of Fine Glass (Crystal) by Moulding and Pressure.—There are but few works in Bohemia which manufacture crystal by moulding and pressing, so that I shall have but very little to say upon the subject.

The principal establishment in which they employ this process is that of Winterberg, where they import from England and France the brass moulds employed, and the articles made are far inferior to the products of our establishments; this is owing, as I believe, principally to two causes:—

1st. That the Bohemian crystal is much less fusible and less fit for moulding than our lead glass.

2d. That in our best glass works the use of brass moulds is now almost entirely replaced by those of cast-iron, which, besides the advantage of lasting longer, are susceptible of a far finer polish, and upon the glass moulded in them, the striæ, so remarkable upon articles made in brass moulds, are scarcely to be seen.

Manufacture of Watch Glasses.—Hollow globes of glass are first blown of sizes and thicknesses varying with the convexity and thickness of the glasses required: a model glass is then laid upon the globe, and the red hot stem of a clay pipe is passed around its edge; the slightest shock is then sufficient to detach it, and it is finished by grinding.

Chapter VIII.—*Of Colored Glass.*

Colored glasses are divided into those which are uniformly colored throughout, and those which are only colored in particular places.

To prepare the first, the coloring materials are introduced into the glass pot.

It is different in the second case, which is used especially for the more expensive colors, and those most difficult to procure, as well as in three operations peculiar to colored glasses, which consist, 1st, in making colored, or colorless, glass vessels with a foot of a different color; 2d, in making vessels with an interior very thin and very highly colored layer, and with an exterior of colorless glass, which may then be ground off in places without spoiling the uniformity of the tint; 3d, in forming the vessels in the opposite way, that is, an interior colorless layer, and an exterior more or less thick colored one, which is then ground off in places, so as to obtain a glass which presents all the shades of the color.

To obtain these results it is enough, in the first case, to solder the bottom of the vessel to a lump of colored glass fixed to the end of another tube, then to separate the first tube, and finish as usual; in the second case, the tube is dipped successively into pots of the colored and of the colorless glass; and in the third case, the operation is reversed.

As we have already said, there exist certain colored glasses which are not prepared in pots, but in rolls of very deep color, about 1.2 inch diameter, and a foot long. These are more fusible than the colorless glass, and are such that they melt at the temperature necessary for the complete fusion of 64 parts of colorless glass, and one of peroxide of manganese. When one of these rods is to be used, a piece of the proper size is broken off, fixed at the extremity of a tube, softened in the furnace, and worked as has been explained.

These preliminaries being settled, I pass to the description of the different matters which are used to color glass.

Ruby.—The manufacture of this color, which is extremely difficult to prepare, and is employed only in roll, is still involved in some obscurity. All the establishments which I have visited obtain their color from the manufactory of M. Meyer, at Stubenbach, near Berg-Reichenstein. According to a manufacturer of the Riesengebirge, the glass which they use for preparing the cakes of ruby color, (which bears the name of schmelze,) is composed of silica 500, minium 800, nitre 100, calcined potassa 100. A solution of gold is then prepared by treating 10 grammes* of fine gold with 180 aqua regia, by the aid of heat; when all is dissolved the liquid is poured into a vessel holding about a quart, which is then filled up with aqua regia. It is then poured into a second graduated vessel, and five times its bulk of water added. When this is done, they mix intimately 512 of schmelze, 48 of prismatic borax, 3 oxide of tin, 3 oxide of antimony, reduced to very fine powders, and $\frac{1}{80}$ of the solution prepared as above.

The whole is then heated for 12 or 14 hours in an open crucible, placed in a glass furnace, and then suffered to cool in an annealing oven. When it is cool they break the crucible, and take out the color. It is not necessary to use closed crucibles, as some manufacturers assert.

If more acid is used than is prescribed above, the crucible is attacked, but the color is more solid.

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* The French gramme is equivalent to 15.438 grains troy.

The purple of Cassius is only mechanically mixed in the glass, and if this be remelted it often becomes dull, and striæ are formed, which are nothing more than extremely fine particles of reduced gold. In certain cases the quantity of oxide of tin used in the above mixture must be from 2 to 4 parts. The first of these mixtures is used especially for large pieces which have to be worked a long time in the fire; the second, for small and delicate articles. Nevertheless, as the process does not always succeed, the greater part of the manufacturers prefer, as I have said, to buy the color ready made from other manufacturers, who devote themselves exclusively to this. The antimony appears, in this case, merely to give brilliancy to the glass without coloring it at all.

According to the director of one of the glass works in the neighborhood of those of Bohemia, a very beautiful ruby color may be obtained in the following way:—Dissolve by heat one gramme (15.4 grains troy,) of fine gold in an aqua regia composed as follows,—12 grammes nitric acid, 12 grammes muriatic acid, and 1 gramme sal ammoniac. Again, dissolve by heat 1 gramme of tin, in an aqua regia composed of 20 grammes nitric acid, and 6 muriatic acid; then pour the two solutions into a large vessel containing already 500 grammes of clear water, and mix them intimately by agitating the vessel after corking it. The red precipitate of purple of Cassius, which forms, is washed and dried with care. A peculiar glass is then prepared by mixing together 40 parts of very pure quartz pulverized, 16 parts of nitre, 8 parts of borax, 1 part of white arsenic, 1 part of cream of tartar, finely pulverized and sifted through silk; and a greater, or less, quantity of the purple of cassius, according as you want a more, or less, deep color. This mixture is introduced into a clay crucible made expressly, not glazed, and of about the capacity of 5 quarts, or else in an ordinary glass pot, then heated in a glass furnace, or in a small furnace made expressly for it, taking care to stir the materials continually until they have attained a dull red heat. The crucible is then covered, and the heat continued for some time. When the mass is perfectly melted, and gives no more bubbles, the crucible is removed, and after suffering it to cool for 4 or 5 hours in a cellar, it is broken, and the glass obtained separated with care from the impurities which it may contain; it is then ground and sifted. If now there be melted together in a small crucible placed in the glass furnace, the following mixture:—128 parts of pure quartz pulverized, 64 parts of nitre, 3 parts of borax, and 3 parts of white arsenic; and the glass thus obtained poured into cold water, then ground, and passed through a sieve, then mixed with the colored glass prepared as above, and melted in a glass crucible, a glass will be obtained, which, worked up into articles of a thickness not exceeding 0.16 to 0.2 inch, takes a beautiful ruby color when exposed to the smoke obtained from burning fir, or that of alder.

Bohemian Ruby-Red—They prepare besides, in Bohemia, a peculiar ruby color, which is also employed in cakes, and has received the name of *Bohemian Ruby*. It is prepared by melting together quartz powdered and fritted 100, minium 150, potassa fritted 30, borax fritted 20, sulphuret of antimony 5, peroxide of manganese 5, fulminating gold rubbed in with oil of turpentine 5. If a little more fulminating gold is used a magnificent ruby color is obtained.

Fulminating gold is obtained by precipitating the solution of gold in aqua regia by ammonia, and stirring the liquid for some time. The precipitate is then collected upon a filter, and washed rapidly with water boiled, and rendered slightly ammoniacal, then dried at a very low temperature. There is thus obtained a powder of a deep brownish yellow, very explosive, and of which the manipulation requires great precaution.

Ancient Red called Kirschroth (cherry red.)—This color is generally employed in cake; it is procured by the use of sub-oxide of copper, which is kept in the state of sub-oxide by the addition of an equal quantity of protoxide of tin. When it is desired to pass the color to a fiery red, a little oxide of iron is added. The proportion of oxide of tin must then be reduced, and it may entirely disappear, as in a very beautiful antique red glass, found at Caprea, in the villa of the emperor Tiberius, the analysis of which gave,

Silica, . . .	71.
Protoxide of Lead, .	14.
Suboxide of Copper, .	7.5
Peroxide of Iron, .	1,
Alumina, . . .	2.5
Lime, ...	1.5
	97.5

Sometimes the glass is merely colored with the oxide of copper, and then after the articles are finished they are smoked, which gives them a deep red color.

Blue.—The azure blue color is obtained by the oxide of copper alone, cobalt blue by the oxide of cobalt, or smalts.

Amethystine Violet.—This color is obtained by the oxide of manganese, mixed with a little nitre.

Yellow.—There are five distinct yellows which are prepared as follows:—

1. *Topaz Yellow.*—Prepared with charcoal dust.

2. *Antimony Yellow.*—Prepared with a mixture of glass of antimony and minium.

3. *Orange Yellow.*—Prepared with glass of antimony, minium, and a little oxide of iron.

4. *A peculiar Yellow.*—Very expensive, which is prepared with chloride of silver, and is only applied in a very thin layer, as a sort of enamel, the glass must then be smoked, in order to make the color appear.

5. *Greenish Yellow.*—Which produces a fine effect in day light, but which appears of a dirty yellowish white by the light of a lamp, or candle. This yellow is prepared with the yellow oxide of uranium of commerce, but since this last contains traces of iron, the yellow glass obtained presents almost always a light green tint upon its edges.

Green.—There are four distinct greens:—

1. *Grass Green.*—Which is obtained by the oxide of chrome, or a mixture of glass of antimony and oxide of cobalt.
2. *Bottle Green.*—Prepared with protoxide of iron.
3. *Ancient Emerald Green.*—Prepared with oxide of copper mixed with a small quantity of finery cinders.
4. *Modern Emerald Geeen.*—This color, which is far more beautiful than the preceding, is prepared with a mixture of oxides of nickel and uranium.

Black—Is prepared with peroxide of manganese, oxide of copper, oxide of cobalt, in equal parts; or else with a mixture of finery cinders, peroxide of iron, oxide of copper, or cobalt.

Hyacinth.—The hyacinthine color is obtained with a large quantity of red oxide of iron, and the oxide of nickel.

To be Continued.

On the Chemical Reactions produced by bodies which intervene only by contact. By E. MITSCHERLICH, (Ann. de Ch.)

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Whatever length of time hydrogen and oxygen gases may be left in a state of mixture with each other, they never combine, even in the presence of such bodies as sulphuric acid, potash, or lime, which have a great affinity for water, and which, it would seem, ought to provoke its formation. If, however, metallic platina be immersed in a mixture of these gases, their combination is instantly produced on the surface of the metal.

We may mix these gases in the proportions which constitute water, and in a very short time the hydrogen and oxygen are so distinctly diffused, that each molecule of the one finds itself in presence of a molecule of the other; and since the molecules of gaseous bodies possess an excessive mobility, and as their cohesion is not an obstacle to their combination, as in the case of solid and liquid bodies; and since also we may suppose that the affinity of hydrogen and oxygen in water is equivalent to a pressure of many thousand atmospheres, it must be at once admitted that besides the ordinary forces (raisons) which oppose chemical combination, there is another which prevents the combination of hydrogen and oxygen by neutralizing their natural affinity.

Some bodies in a state of solution act among themselves in the same manner as hydrogen and oxygen, with regard to platina. We may abandon, for a long time, an aqueous solution of cane sugar without perceiving any alteration in it; but if we add to it dilute sulphuric acid, the sugar, without combining with the sulphuric acid, solidifies a portion of water, and is transformed into glucose. The decomposition of gaseous ammonia by incandescent copper, is one of the (not very numerous) examples in which the decomposition of a gaseous body is promoted by a solid body: we have, on the contrary, numerous examples of decompositions of this kind among liquid and solid bodies, which undergo themselves no change during the reaction;—the decomposition, for example, of the binoxide of hydrogen under the influence of various bodies,—the decomposition of chlorate of potash by the oxide of copper, and other fixed bases.

Before we undertake to ascertain why certain chemical reactions take place under the influence of bodies which interfere with each other only by their presence, we must seek to give an account of the manner with which bodies that do not combine chemically, act upon each other when placed in immediate contact.

We may show with the greatest facility the attraction which a solid exerts upon a gaseous body, by employing the first in a condition in which it presents the greatest possible surface under the smallest volume, as in very thin leaves, or better, in impalpable powder. Charcoal, and many substances of difficult fusibility, like platina, which may be obtained in a state of extreme tenuity, are very suitable for these experiments.

I have calculated, in the first volume of my *Traité de Chimie*, the amount of surface in one cubic inch, divided into little cubes of $\frac{1}{2400}$ of an inch on each side, by two series of perpendicular sections. It would be equal to 100 square feet, without estimating the extent of the interstices

If any substance be brought to such a state of tenuity that we may suppose it reduced to its atom, or, at least, to a degree of known approximation, we may then calculate the surface which it would represent.

The estimate may furnish the value of the greatest diameter of an atom of a chemical compound, when the latter is obtainable in the condition of thin plates, or of vesicules, by the colors which they present;—thus the diameter of an atom of water must be, at most, $\frac{1}{100000000}$ of an inch, according to the color which appears at the thinnest portion of a soap bubble.

In reducing a dilute solution of chloride of platina, by means of carbonate of soda, and formic or tartaric acid;—or in decomposing very dilute sulphate of platina by weak alcohol, the metallic platina obtained in either case must be in the state of molecules, since the molecules, at the moment of reduction, are separated by water, which necessarily prevents their agglomeration.

A volume of one cubic inch filled with globules, which we will suppose, for the sake of facility, to have only $\frac{1}{100000000}$ of an inch diameter, but placed in such a manner that the lines passing through their centres be perpendicular, or parallel, to each other, will present a surface of 218,166 square feet. In any other position the surface would be still greater if the globules touched each other. It is possible that platina black has a surface as considerable.

Wood charcoal is the most convenient substance for studying the action of large surfaces on gases, and the experiments of De Saussure, are, on this account, very important. Vegetable fibre does not melt when properly heated, so that the charcoal resulting from its calcination, still preserves the form of the fibre, as we may readily convince ourselves, by placing the transverse section of a carbonized branch under the microscope. We discover every little cell of the plant, and we may assure ourselves that the form of the partitions have remained intact.

The cells of wood charcoal have, as a medium, a diameter of $\frac{1}{2400}$ of an inch; their surface would be equal, therefore, to 100 square feet, if the charcoal itself occupied no space. I prepared some wood charcoal, which weighed .9565 grains, and after boiling it some time in pure water, and wiping simply the surface of it, its weight was 2.2585 grains; its weight under water was .110 grains; the space into which the water had penetrated, and, consequently, into which elastic fluid might have penetrated after the expulsion of the latter, constituted then $\frac{5}{8}$ of the total volume of the charcoal; in reckoning the space occupied by the charcoal itself, we find that the extent of its surface is only 73 square feet. De Saussure found that wood charcoal absorbs 35 times its volume of carbonic acid at the temperature of 12 degrees, and under a pressure of 26.895; but 35 volumes of carbonic acid is found in a space which constitutes $\frac{5}{8}$ths of the total volume of the charcoal, and, consequently, 56 times smaller than the space originally occupied by the carbonic acid.

Agreeably to the experiments of Addami, carbonic acid is liquified under a pressure of 36.7 atmospheres, at a temperature of 12 degrees. We are thence led to conclude that more than one-third of the carbonic acid which is condensed in the pores of the charcoal, is in a liquid state on the sides of the cells.

If 35 cubic inches of carbonic acid are condensed on a surface of 73 square feet, or 10,512 square inches, the thickness of the layer of liquid carbonic acid on the sides of the cells must be .000002 of an inch. This stratum is thicker when the experiment is made with ammoniacal gas, chlorhydric acid, or sulphurous acid, which do not require so enormous a pressure for liquefaction, and which are absorbed in more considerable quantities. Since all porous bodies, in presenting to the gas a considerable surface, act in the same manner as charcoal, we must admit that the gases which are in contact with solid bodies are in a peculiar state, and different from that in which they are when isolated from them; and moreover since the thickness of the layer of condensed gas varies, attraction is exerted not only on the gas which is in immediate contact with the solid body; it acts at variable distances. But porous bodies do not act at their surface only, for if it were so, the absorption of different gases by different substances ought to be in the same proportion. It is not thus, since, according to Saussure, wood condenses proportionally more carbonic acid than charcoal; also asbestos, spongy quartz, cotton, and silk tissues absorb different gases in proportions varying from that of wood charcoal.

The absorbent power of pulverulent substances has been hitherto but very little studied. Platina black, prepared by the method of Davy, far surpasses all others: 10 grains condense .550 cubic inch of oxygen; that is to say, one cubic inch of it would condense 253.440 cubic inches, (Chimie de Platina, by Dobereiner, page 64;) but it is impossible to decide what the volume is which platina takes up when it condenses oxygen, because it is in a state of powder. The property which certain bodies possess, like silex, of condensing the humidity of the air, authorizes us to conclude that they have an aptitude in condensing gases.

As solids attract gases, they are capable, in like manner, of exerting this attraction over solid bodies; thus we may, by means of charcoal, deprive alcohol of the potatoe oil which it holds in solution. In boiling charcoal with water, the oil passes, unaltered, to the latter; this force of attraction carries off solid coloring matters from liquids which hold them in solution.

Some precipitates have the property of attracting a portion of the soluble salts from the fluid around them; they entangle and remove them, but washing sets them free.

I dissolved some nitrate of barytes in 10 parts of water; after having precipitated about half of it by sulphuric acid, I determined the quantity of nitrate of barytes which was held by the clear supernatant fluid. The fluid liquid, arising from the washing of the precipitate, was evaporated, and the nitrate of barytes which it contained was determined.

In subtracting the weight of this nitrate, and the weight of the sulphate of barytes obtained from the total weight of the wet precipitate, the weight of the water contained in the liquid was arrived at. In calculating, from these data, on the one part, the weight of the nitrate of barytes in the liquid which overflowed the sulphate, and on the other part, that of the liquid which moistened the precipitate, it was found that two-thirds only of the latter was dissolved in it, and that the one-third contained in the water used in washing must have been condensed by the attraction exerted by the precipitated sulphate. If, instead of precipitating a solution of barytes, we employ the chloride of barium, the latter is thus drawn away. But if we precipitate a solution of nitrate and sulphate of soda, by nitrate of barytes, and wash the precipitate until a drop of the washing leaves no trace of solid matter on a platina blade, it happens, in this case, that the sulphate of barytes may retain as much as two per cent. of nitrate of soda; to remove it the precipitate must be calcined, and then washed.

The sulphate of barytes, therefore, exerts an attraction so weak on the chloride of barium as to be unable to remove it from its aqueous solution; but with respect to the nitrate, the attraction is so strong as to render a great quantity of water necessary to clear it; but water is incapable of removing completely, from sulphate of barytes, the nitrate of soda which it retains at the moment of its formation.

One may very easily judge of the force of attraction which solid bodies exert upon each other by considering the action of cement upon wood and glass. If we cover a plate of glass with moist bladder, and, when dry, try to detach it, we tear off portions of glass. The action of the bladder upon the glass is stronger, therefore, than the cohesion of molecules of the glass itself; but if we allow the plate of glass and bladder to remain some time in boiling water, the gelatine is dissolved, and the bladder is easily removed.

Although this attraction is very strong, it is less considerable than that of sulphate of barytes for nitrate of soda. The attraction which solid bodies have for liquids and gases is manifest not only by immediate contact, but also at a determinable distance. We may prove it by using plates of glass, or of quartz, having two perfectly smooth faces. The first is to be suspended, and the other furnished with the means of attaching weights. I deprived two plates, thus disposed, of all adhering humidity; the thinnest layer of it interposed, shows itself by the production of the colored rings of Newton. By compressing these plates afterwards, until the colored rings begin to appear, we may easily determine their distance. At the appearance of the second ring, the lower plate, whose weight was 14 grammes, remained attached to the first. The contiguous surfaces were but one inch square; when pressed together, so that the black appeared over nearly the whole of the first ring, several pounds might be suspended from it. By having this apparatus for some time under the air pump, the plates did not separate, so that atmospheric pressure was not the cause of their adherence.

We know that this kind of attraction takes place generally during the crystalization of bodies. A body dissolved deposites itself on threads, or solid bodies, suspended in the liquid, much quicker than if these are not present. Crystals are formed much faster around a crystal already formed than in any other portion of the liquid, when, for example, the force of the solvent is lessened by a diminution of its temperature. The solvent force of water is, therefore, less energetic near a formed crystal than at a certain distance from it.

In some cases it is easy to account for the chemical combinations which the action of solid bodies on liquids and gases may excite, but in others the explanation becomes more difficult. It is possible that condensation alone may be the cause of it in gaseous bodies. We may, in this way, very well explain the distinction which M. Thenard observed, on introducing charcoal into a mixture of sulphhydric acid and oxygen. When platina black, which has condensed oxygen, is placed in contact with chlorhydric acid, there results, according to Dobereiner, chloride of platina. We know that, in this case, the condensed oxygen may readily seize the hydrogen of the acid; and yet the affinity of chlorine for platina interferes in the case. The affinity of gold for chlorine provokes the decomposition of nitric acid by chlorhydric acid, when leaves of gold are placed in aqua regia, since the latter contains free chlorine only after it has been warmed, or after being for a long time left to itself.

When a gas is in the nascent state, a phenomenon is presented analogous to those just mentioned; the gas combines often with a body in contact with it, which, in other circumstances, would produce no action upon it. Thus, in the cases in which the chemical affinity of two gases is weak, it may happen that their condensation causes them chemically to combine.

Nevertheless it appears doubtful whether we ought to attribute the combination of two bodies, which, like oxygen and hydrogen, have so strong an affinity for each other, to the effects of condensation alone, though we may be authorized to grant that in the various physical conditions of platina a condensation of gas takes place at its surface.

We know that in leaf and in fine wire, platina acts as well as in the precipitated, or spongy, state, or in black; but the combination is slower as the surface used is more limited.

The leaves and sponge of platina do not condense a large quantity of oxygen; but in comparing their surfaces with that of platina black, we perceive that it ought to be so. The sponge of platina arising from the decomposition of the double chloride of platina and potassium is formed at a temperature at which the mixture begins to agglomerate, and presents itself under the form of plates, which cannot certainly possess a surface large enough to admit of an easy appreciation of gaseous condensation.

An experiment first made by M. Fusinieri, and is easily repeated, proves that air and moisture are condensed on the surface of glass. If we pour into a glass tube boiled mercury, which has been cooled in a vacuum, we find that it gives out air, when heated, even when the precaution is taken to assure ourselves by the microscope, that no traces of it adhere to the sides of the glass; but if into a tube of glass which has been exposed to a high temperature, we pour mercury by means of a funnel whose point touches the bottom of the tube, and then heat the tube, not a bubble of air escapes, even when mercury is used which has been agitated with air and water, and left to dry by simple exposure to free air. The gaseous bubbles then which the mercury, in the first experiment, yielded, must have come from the air and moisture condensed on the sides of the tube; but the quantity of air and water, thus condensed, is so trifling, its presence can only be proved by such an experiment as above stated.

It would be impossible to prove the condensation of any gas whatever on the surface of platina leaves, even supposing it to be as considerable as that of the carbonic acid on the surface of charcoal.

A mixture of alcohol and oxygen act, in the presence of platina, absolutely in the same manner as a mixture of oxygen and hydrogen. Oxygen is devoid of action on weak, or concentrated, alcohol. Platina black provokes their combination. Other bodies also do the same. It has been thought that to effect this reunion it was necessary to recur to the use of ferments; but M. Duflos has proved that chips of wood, soaked in acetic acid, act in a manner analogous to platina black. One might have supposed that the acetic acid thus used had deposited some ferment on the wood; but these ferments would soon have been decomposed by the oxygen of the air, and M. Duflos has proved that with chips, or shavings, alone, we may transform alcohol into acetic acid for months together.

When acetic acid is prepared by exposing beer, or fermented liquors of this kind, to the action of air, they become turbid, and deposit matters of an organic nature. These spongy matters, acting after the manner of platina black, will condense oxygen, and thus determine the combination of these bodies.

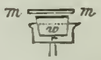
To be Continued.

On a Voluimnimeter. *By* M. Hermann Kopp.—Ann. de Chimié, from Ann. des Mines.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

I have given this name to a new instrument which may readily serve to determine the volume of any substance, solid, or liquid, and thus furnish the density of various bodies for which the ordinary methods are insufficient.

Fig. 3.



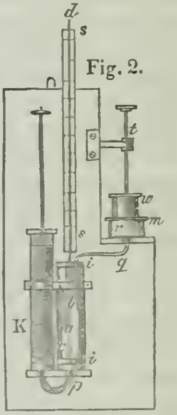


Fig. 2.

The instrument is constructed in the following manner:—K, fig. 2, is a pump in which moves a solid piston; this pump communicates below by means of a bent tube *p*, with a cylinder *i i*, the upper part of which is closed, and pierced by two tubes *c d*, and *i q*. The straight tube *c d*, open at both ends, is prolonged upwards, and fitted with an arbitrary scale, the zero of which is at a short distance from the cylinder. The tube *i q*, bent as in the figure, enters the bottom of the cylindrical vessel *r*, the vertical parts of which are represented in fig. 3. At the upper part of the same cylinder *i*, *i*, are fixed several platina points *a b*, ... of different lengths.

The vessel *r*, contains another vessel *w*, in which is placed the body to be subjected to the experiment. A disk *m m*, compressed by means of a screw *t*, and of an elastic body *u*, hermetically closes the vessel *r*, the borders of which are worked for this purpose. The pump K, the tube *p*, and the lower part of the cylinder *i i*, are to be filled with mercury.

Thus arranged, let x, be the volume of air enclosed in the cylinder i i, commencing at c, in the vessel r, and in the tube of communication i q. Let y, be the quantity by which the volume will be diminished by lowering the piston so as to bring the mercury in contact with the point a, and let B, be the common height of the barometer, we shall have, for the height of the column of mercury in c d, $\frac{y}{x-y}$ B, the measurable height, and which I will suppose equal to $\frac{1}{n}$ B; n, having been accurately determined, once for all, for the same point a. We shall then have $y = \frac{1}{n+1} x$.

If now we introduce into the capsule n, a body of known volume z, and compress it to the extent of the volume y, we shall have, in designating by h B, the new height of the column of mercury in the tube c, d:

$$\frac{\frac{x}{n+1}}{(x-z)-\frac{x}{x+1}} \text{B} = h\,\text{B}.$$

Whence,

$$x = \frac{(n+1)h}{hn-1}z;$$

from which the value of x is determined, once for all, for the same instruments.

Then, if we wish to determine the volume of any body z, we subject it to experiment like the body z, and we have, in designating by h, b, the weight of the mercury c, d, for the body z:

$$x = \frac{(n+1)h}{hn-1}z;$$

and on this occasion x being known, we deduce from it the value of z.

The instrument is provided with several points of platina, so that various experiments may be made on the same bodies which control each other, and allow of an accurate mean.

The following are results obtained by this instrument, which, agreeing well with results directly obtained, enable us to place confidence in its indications.

Names of Substances.	Density obtained by the Voluminimeter.	Density by common method.	
Lead,	11.404	11.373	
Tin,	7.363	7.38	
Sal Ammoniac,	1.50	1.45	Wollaston
		1.53	Mohs..
Chloride of Sodium,	2.15	2.08	Harslen.
		2.26	Mohs.

This coincidence induced me to employ the voluminimeter for determining the density of various substances, which the methods commonly employed could not accomplish. The following are my results:—

Names.	Density.	Names.	Density.
Pumice stone,	2.15	wood of linden,	1.13
Ashes of beech,	2.85	" fir,	1.16
Wheat flour	1.49	" walnut,	1.17
Starch,	1.56	" apple tree,	1.20
Flax, (for spinning,)	1.46	" plumb,	1.23
Silk, (from cocoon,)	1.55	" pear,	1.23
Cotton,	1.27	" oak,	1.27
Wool,	1.29	" beech,	1.29
Cork,	.33		

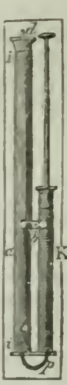
The several woods experimented upon were reduced to powder by rasping, and dried at a temperature of about 100 degrees.

On a new shortened portable Barometer. By HERMANN KOPP.—Ann. des Mines: (Ann. de Ch. t. vi.)

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

The instrument which I am about to describe, and which appears to be worthy the attention of philosophers and intelligent travelers, is constructed on this principle:—"If a like volume of air in different states of condensation be compressed by a like quantity, and be at liberty to act on a column of mercury, this column will rise in proportion to the density of the compressed air before compression."

It is composed of two cylinders in their glass K, and *i i* communicating at the lower part by means of a bent tube *p*. In the cylinder K, is a solid piston. The cylinder *i i* is closed at its upper part, except that this part is traversed by a tube *c d* open at both ends. The body of the pump K, and the tube *p*, are filled with mercury, which, when the piston is at the highest point of its course, rises a few lines in the cylinder *i i* so as to leave the lower end of the tube *c d* open, which thus puts the air of the cylinder into communication with the atmosphere. To the tube *c d* there is adapted a platina wire whose two extremities, pointed and blackened, are fixed as *a* and *b*. On the same tube *c d* is traced an arbitrary scale whose zero is a little above, at a known and invariable distance from the points *a* and *b*.



Thus arranged, if the piston in K be depressed, the mercury will rise in *i i* will soon close the opening *c*, and then will compress the air in the cylinder. The piston is to be brought down until the mercury rises to *a*, for example. This compression will raise the mercury in the tube *c d* and from the height of this column, easily estimated by adding to the length indicated by the scale, the invariable distance from the point *a*, to the zero of this scale, the pressure of the atmosphere may be deduced.

To do this it will be sufficient to have determined by some previous trials, the constant relation which subsists, under the same circumstances, between the height of the common normal barometer, and that of the barometer now in question. This relation is determined by taking the mean of the relations of a certain number of observations made simultaneously with the two instruments; and when, on occasion, we wish to bring the heights given by the new barometer to the common barometric heights, we multiply them by this constant coefficient.

It is needless to say that at each observation the barometer must be placed vertically, and left to acquire an equilibrium of temperature with the ambiant air.

The second point *b*, serves to render the instrument double, so to speak, in order to make an experiment controling the former. The constant coefficient must, in this case, have been previously determined for that point.

A condition essentially needful in the construction of the instruments, is that the highest point *b*, must never be so high that the mercury, in reaching it, will rise in the tube higher than the upper part of the scale, and yet that it must come near it in order to profit by the whole length of the scale. The position which this point should occupy is easily determined. Let L be the length *c d*, D, the distance from *b* to *c*, then for the greatest possible barometric height

H, we have $D+\frac{D}{L-D}H<L$; (L D and H estimated by the same measure.)

This instrument, easily used, and, above all, easily and conveniently carried, has served me during a five months' journey. I subjected it to all sorts of trials, with respect to its solidity and invariability, and I am convinced that it gives barometric pressures with an error less than half a line, and more commonly with still greater exactness, although it is seldom more than 25 centimetres in height.

Memoir on a New Process of Chlorometry. By M. Lassaigne, (Compte Rendu de l'Acc.)

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

This process appears to me worthy of all preference to the chlorometer with an indigo test, by the unchangeableness of the proof liquor made use of, and by the exact and constant results which it furnishes. It rests on the precise knowledge of the proportion of any gaseous chlorine which is sufficient to decompose a determinate weight of pure ioduret of potassium, in order to become transformed entirely into chloride of potassium, and perchloride of iodine, both of them compounds soluble in water: the decomposition of this ioduret is easily marked by a small quantity of solution of starch, which, added to portions of ioduret at the moment of pouring in the chloric solution, gives immediately and successively the blue, violet, green, red, and yellow colors, as long as the smallest portion of free iodine remains. As soon as the decomposition is complete, the decolored liquor resumes the transparency and limpidity of distilled water;—this reaction enables us to appreciate the change much better than when we operate with the sulphuric solution of indigo, which, we know, remains always of a reddish yellow, more or less deep at the precise period of completing the test.

An equivalent of pure, dissolved, ioduret of potassium, requires, for its complete decomposition, six exquivalents of dry chlorine. The result is one equivalent of chloride of potassium, and one equivalent of perchloride of iodine ICh^5. From these data one litre of dry gaseous chlorine at a pressure of .76 m., weighing 3.208 grs., decomposes 2.482 grs. of ioduret of potassium.

Therefore, in dissolving this quantity of ioduret of potassium in a litre of distilled water, a normal solution is prepared which requires for its total decomposition a volume equal to its own, of dry, gaseous, chlorine. For the operation we put into a glass vessel a measured quantity of the solution, and add to it a small quantity of solution of starch, (prepared by dissolving a gramme of starch in a hundred grammes of warm water, and filtering it when cold, or by rubbing in an agate mortar some dry starch, and treating it with 100 parts of cold water.) Put the starch solution into the crust with a bent neck, usually employed in chlorometric assays, and add it drop by drop to the given solution of ioduret, mingled with starch solution, and stop at the moment in which the liquid, after passing through all the shades mentioned, becomes extremely clear. The quantities of chloric solution are in inverse ratio with the proportions of chlorine which they contain. The only precaution necessary in the assay, is to hold in the left hand the glass which contains the measured ioduret charged with eight or ten drops of starch solution, and twirling it round a little, pour into it from the right hand the chlorated solution contained in the crusts.

The determination of the value of an alkaline hypochlorite is effected in the same way in operating upon a recent solution of the salts made in the proportion of ten grammes to a litre of water. One condition only it is important to observe, in order that the operation be quickly and accurately performed; that is, to add to the test solution, charged with starch, a drop or two of concentrated sulphuric acid, for the purpose of disengaging chlorine, when the solution of hypochlorite is added. If this be not attended to, the operation is slow, and requires repeated additions, for to the coloring and discoloring produced by the first drops of hypochlorite in the non-acidulated proof liquor, succeeds spontaneously a fresh coloration which is soon destroyed by a few drops of hypochlorite, and this effect continues four or five times in succession, until the ioduret of potassium is decomposed.—*Ann. des Mines*, tom. iii, liv. 11.

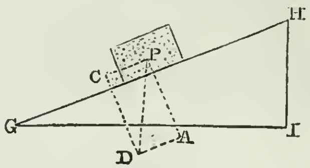
FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the Diameter of Screws. By JAMES DEAN, A.M., A.A.S., &c., and late Prof. Nat. Phil. and Ast. Univ. Vt.; investigated in 1825.

Every attentive student must have been surprised, on his first examining the investigation of the mechanical powers, at finding that the *diameter* of the screw was not an element in expressing the ratio of the power to the weight necessary to produce an equilibrium; and that, other things being equal, the diameter of the cylinder may vary *ad infinitum*, without, in the least, affecting that ratio. That reducing, or increasing, the diameter to an extreme degree, the distance of the threads remaining the same, will diminish the effect of any given power, will be universally admitted without any very nice reasoning on the subject; but it seems far from useless to ascertain the *exact* diameter, which, under any given circumstances, will enable a given power to produce the greatest effect, and it is very natural to look among the effects of friction for this as well as other deviations from abstract theory. Now the ratio of the friction to the pressure which produces it, has been found by Amontons, Parent, Coulomb, &c., to be very nearly constant between the same surfaces, and commonly about one-third. And as the writer cannot learn that friction is much considered in this country as a retarding and computable force, he takes the liberty of translating from Bossut's Mechanics, those sections in which he treats of friction as affecting inclined planes.

269. Let a body P, be placed on an inclined plane whose length is G H, height H I, and base G I; resolve the weight of the body, represented by the vertical line P D, into two other forces P C parallel, and P A perpendicular, to the inclined plane. It is obvious that the force $PC = P \times \frac{HI}{GH}$, and the force $PA = P \times \frac{GI}{GH}$. The first of these two forces, called the relative weight of the body, tends to make it slide down the plane, while the second produces a pressure on the plane, and causes a friction of the first species, so that putting n, for the ratio of the pressure, the friction $= nP \times \frac{GI}{GH}$. If, therefore, the body be left entirely to itself, it will not descend unless its relative weight P C, be greater than the friction, that is, unless $\frac{P \times HI}{GH} > nP \times \frac{GI}{GH}$, or $HI > n \times GI$.

Fig. 1.



Hence, a body laid on an inclined plane, and left to the action of its weight only, will not descend unless the height of the plane is greater than the product of the base multiplied by the ratio of the friction to the pressure.

270. Let a body be ready to descend, or let its relative weight be equal to the resistance of friction $HI = n \times GI$, or $n = \frac{HI}{GI}$. Thus, when the inclination of the plane is such that a body may be ready to descend by its own relative weight, the ratio of the friction to the pressure is that of the height of the plane to its base. Knowing, therefore, either of these ratios the other is known also.

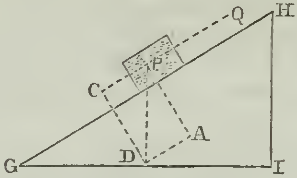
Suppose, for example, the friction to be one-third of the pressure $\frac{HI}{GI} = \frac{1}{3}$, and by trigonometry the ratio $\frac{HI}{GI}$ may be considered as that of the tangent of the angle of inclination H G I to radius, and by trigonometric tables, this last ratio being $\frac{1}{3}$, the angle H G I is about 18° 26′. So that the friction being taken at one-third of the pressure, the angle of inclination of the plane must be about 18° 26′, that the body may be on the point of descending by its own relative weight.

If, on the contrary, the angle of the inclination of the plane be given, the ratio may be found by the tables, which is the value of n. This furnishes a very simple and convenient method of ascertaining friction by experiment. It is only necessary to lay the body on a plane at first very little inclined to the horizon, and gradually increase the inclination until the body begins to descend, and the ratio of height of the plane to its base is that of the friction to the pressure.

271. We will now consider a body which some power is ready to raise along an inclined plane, by overcoming its relative weight and friction. It is easy to find the general value of that power, but we shall confine ourselves to the two cases which most frequently occur,

viz., when the direction of the power is parallel to the length of the plane, or to its base. The one method may easily be extended to every other case.

Fig. 2.

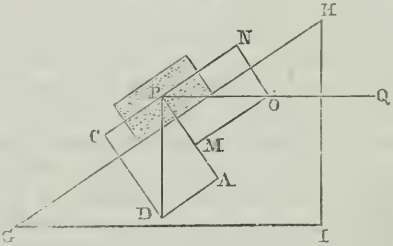


272. In the first place, let the power Q, act in a direction parallel to the length of the plane. In order that the body may begin to slide in the direction G H, the force Q, must be equal to the sum of the relative weight of the body and the friction. But in constructing, as above, the rectangle P A D C, and always calling n, the ratio of the friction to the pressure, the force, or relative weight, $PC = P \times \frac{HI}{GH}$, the force $PA = P \times \frac{GI}{GH}$, the friction $= nP \times \frac{GI}{GH}$; and, therefore, $Q = P \times \frac{HI}{GH} + nP \times \frac{GI}{GH}$, a formula which exhibits the quantity by which the friction enters into the expression of the power Q.

Example.—Let the weight $P = 8000$ lbs., the angle of inclination $HGI = 30°$, or $\frac{HI}{GH} = \frac{1}{2}, \frac{GI}{GH} = \frac{1.73}{2} = 0.866$, very near, and $n = \frac{1}{3}$, then $Q = 4000 \text{ lbs.} + 2309.4$. The power Q must, therefore, be more than 6309.4, while without friction it would be only 4000 lbs.

273. In the second place, let the power Q act in the direction parallel to the base of the inclined plane. Having resolved, as above, the weight of the body into two forces P C, and P A, the one parallel, the other perpendicular, to the inclined plane, resolve in like manner the power Q, expressed by the part P O, of its direction, into two other forces P N, and P M, the one parallel, the other perpendicular, to the length of the plane. Then the force,

Fig. 3.



$$PC = P \times \frac{HI}{GH},\ PA = P \times \frac{GI}{GH},\ PN = Q \times \frac{GI}{GH}, \text{ and } PM = Q \times \frac{HI}{GH}.$$

The whole pressure on the inclined plane being equal to the sum of the two forces P A, P M, if n always represents the ratio of the friction to the pressure, it is plain that the friction,

$$= n \times \left(P \times \frac{GI}{GH} + Q \times \frac{HI}{GH} \right)$$

This being premised, in order that a body may be ready to slide in the direction G H, the force P N must be equal to the sum of the force P C, and the friction, or

$$\frac{Q \times GI}{GH} = \frac{P \times HI}{GH} + n \times \left(\frac{P \times GI}{GH} + \frac{Q \times HI}{GH} \right),$$

whence,

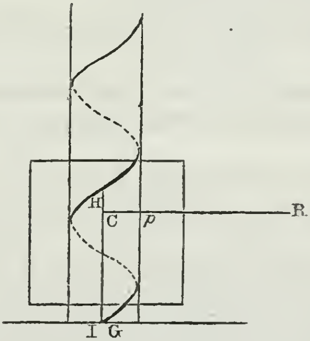
$$Q = P \times \frac{HI + n \times GI}{GI - n \times HI}.$$

Without friction the value of the power would be $\frac{P \times HI}{GI}$, so that $\frac{P \times (HI + n \times GI)}{GI - n \times HI} - \frac{P \times HI}{GI}$, or $\frac{nP \times \overline{GH}^2}{\overline{GI}^2 - n \times GI \times HI}$, is the quantity by which the friction increases the power.

Example.—Let $P = 8000$, $HGI = 30°$, or $\frac{HI}{GH} = \frac{1}{2}, \frac{GI}{GH} = \frac{\sqrt{3}}{2} = .866$, $n = \frac{1}{3}$. It will be found that $Q =$ almost 9021.7 lbs. Without friction the power would be only about 4618.8 lbs.

Of Friction in the Screw.

Fig. 4.



Let the inclined plane G H I, expressing the last value of Q in the above paragraph, as the power in the screw always acts in a direction parallel to G I, or perpendicular to the axis of the cylinder, be wrapped round a cylinder of such radius C p, that G I, the base of the triangle, shall be just equal to the circumference, and, of course, just reach round it; and let G H, the inclined plane itself, be produced in the *same direction* an indefinite number of turns around the cylinder. Here then obviously G H, forms one thread of a screw, while H I, the height of the inclined plane, is equal to the distance of the threads parallel to the axis. Then let a nut be perforated, and formed in the interior, so as to correspond to the thread of the screw, applying itself to the surface G H, in its whole length, and perhaps two or three other turns, and let the weight P be laid on the nut, the friction is the same whether it be supported on a small, or large, surface, and let this nut be furnished with a lever C R, perpendicular to the axis, and extending to R, the point where the new power q, is applied, make an equilibrium with the weight P, and its friction in the same manner as Q does at the surface of the screw. On the principle of the lever, $q : \mathrm{Q} :: \mathrm{C}\,p : \mathrm{C\,R}$, or $q = \mathrm{Q} \times \frac{\mathrm{C}\,p}{\mathrm{C\,R}}$. Let this equation be incorporated with that expressing the value of Q in the inclined plane, where the power acts in a direction parallel to the base, and we shall have $q = \mathrm{P} \times \frac{\mathrm{C}\,p \times (\mathrm{H\,I} + n \times \mathrm{G\,I})}{\mathrm{C\,R} \times (\mathrm{G\,I} - n \times \mathrm{H\,I})}$. This is the formula for the screw as commonly constructed; $\mathrm{P} =$ the weight to be raised, $q =$ the power necessary to just not produce motion when acting at the distance C R, and in a plane perpendicular to the axis C, $\mathrm{C}\,p =$ the semi-diameter of the screw, $\mathrm{H\,I} =$ the distance of the threads measured parallel to the axis, $\mathrm{G\,I} =$ the circumference of the screw, $n =$ the ratio of the friction to the pressure.

Now, in order to find the value of C p, when q is a minimum, the other quantities remaining constant, P and C R being omitted, as affecting all the terms equally, for conciseness' sake let $\mathrm{C}p = x$, $\mathrm{H\,I} = h$, and $\pi = 6.28$, &c., and the fraction will become $\frac{hx + n\pi x^2}{\pi x - hn}$, which has its least value when its differential,

$$\frac{h\pi x dx + 2n\pi^2 x^2 dx - h^2 n dx - 2hn^2 \pi x dx - h\pi x dx - n\pi^2 x^2 dx}{\overline{\pi x - hn}^{\,2}} = 0,$$

whence $\pi^2 x^2 - 2hn\pi x = h^2$ and πx, (the circumference of the screw,) $= h \times (n + \overline{1 + n^2}\,^{\frac{1}{2}})$ from which the diameter may be computed as usual.

From the denominator of the first fraction in the last paragraph, it appears that when $hn = \pi x$, that is, when the circumference of the screw : distance of the threads : : the friction : the pressure, the denominator becomes 0, and, therefore, the power q must become infinite, or the effect 0. When this is the case, if h, or the perpendicular height of the inclined plane, formed by one revolution of the thread, be taken $= 1$, or radius, then $n = \pi x$ the circumference of the cylinder, or base of the plane, or cotangent of the angle contained between any thread and a plane perpendicular to the axis. Let a represent this angle, then $n = \cot. a = \frac{\cot.^2 \frac{1}{2} a - 1}{2 \cot. \frac{1}{2} a}$ by an :trig: whence $\cot.^2 \frac{1}{2} a - 1 = 2\, n \cot. \frac{1}{2} a$, and $\cot. \frac{1}{2} a = n + \overline{1 + n^2}\,^{\frac{1}{2}}$, which is precisely the value of the circumference given by the calculus when the effect is greatest, so that the angle of inclination at which the greatest effect is produced, is exactly half of that angle which, with the same degree of friction, is the limit of all effect.

From the calculus it appears that screws are commonly made much too large in proportion to the distance of the threads, to produce any given effect with the least power, the circumference in hardly any practical case being, for that purpose, greater than twice the distance of the threads, and the diameter much less than that distance. Thus, suppose it be desired to produce a pressure equal to ten tons, with a screw whose threads are one inch asunder, lever eight feet long, and friction one-third the pressure; if the screw be six inches in diameter, the power must exceed 275 lbs., if the diameter be only two inches, any power greater than 122 lbs., will be sufficient. If the friction amount to half the pressure, the dimensions still remaining unaltered, the powers corresponding to the same two diameters, will be 398 and 168 lbs. respectively. The least powers with these two degrees of friction would be 72 lbs. and 98 lbs., and require diameters only 0.4416 in., and 0.515 in. respectively; but no substance is known, which, when reduced to even twice these dimensions, would have strength enough to resist the torsion. It appears, therefore, that a screw, as an engine of force, with any given distance of thread, ought to be made as small as the strength of the material will admit.

In order to ascertain, by computation, the middle course between wasting materials, labor, and power, on one hand, and hazarding the failure of the machine on the other, we may adopt the doctrine "that in resisting torsion the whole lateral cohesion is exerted at $\frac{1}{4}$th the radius of the cylinder from the centre."* The notation of the formula for the screw being retained, and S being put for the lateral cohesion of a square unit of the substance used, the area of the section is $\frac{\pi x^2}{2}$, and its strength $\frac{S\pi x^2}{2}$, then $CR : \frac{x \,..\, S\pi x^2}{4 \,..\, 2} : \frac{S\pi x^3}{8CR} =$ the force of the cohesion at the end of the lever, which, being substituted for q, in the formula $\frac{S\pi x^3}{8CR} = \frac{P \times (hx + n\pi x^2)}{CR \times (\pi x - hn)}$, and this equation being reduced, gives $x^3 - \frac{hn}{\pi} x^2 - \frac{8Pn}{S\pi}, x = \frac{8Ph}{S\pi^2}$, in which, if the known quantities are properly substituted, the value of x may be safely adopted as the radius of the cylinder.

But when the exertion of great force, or the weakness of the material, renders a large cylinder indispensable, the distance of the threads should be greater also, because increasing the distance of the threads does not require, by any means, a proportional increase of power. Thus with the six-inch cylinder, above mentioned, with the friction of one-third, increasing the distance of the threads from one to two inches, requires an increase of power less than one-sixth, viz., from 275 lbs. to 319 lbs.; and with a friction of one-half the increase is only one-eighth, or from 398 lbs. to 448 lbs., which may generally be compensated by using a longer lever, while the action will be much more prompt and rapid. And less than double the power will produce the same effect, though the distance of the threads be made equal to the diameter of the screw, or six times their former distance. The reason of this will be obvious, when it is considered that in this case the whole power except 37 lbs. is employed in overcoming the friction, and that at such a small angle of elevation, the pressure, and, consequently, the friction, is but slightly varied by a variation of that angle. And with the same distance of the threads, if the diameter receive successive increments, the ratios of the corresponding powers will continually approximate to the corresponding ratios of the several diameters, because the effect of friction, which absorbs most of the power, is proportional to its distance from the fulcrum.

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* Edin. Encycl. vol. v, p. 400; art. "Carpentry."

But after all it is far from being eligible, in practice, *always* to give screws the shape above described, especially in the fastening of instruments, or machines, where the object is not to produce but to prevent motion, because if the distance of the threads be greater than n times the circumference, the friction of the screw will not prevent it from running back. On this account it may not be improper to investigate the figure of a screw so formed, that, without making the angle of ascent of the thread more acute than necessary, yet the friction shall always hold it where the power leaves it. Let it be required, therefore, so to shape a screw, that with any given degree of friction the power necessary to turn it forward shall have a ratio to the power necessary to turn it back equal to the ratio of the two given quantities $f : b$; f being, of course, larger than b. As the length of the lever to which these powers are applied, cannot effect their ratio to each other, they may be considered as applied at the surface of the cylinder, and this surface may be further considered, as extended on a vertical plane, in which case one revolution of the thread is the length of an inclined plane, the circumference of the cylinder is its base, and the distance of the threads its height; reversing the course of reasoning adopted in the first two sentences of the description of the screw. Bossut, in Art. 273, as translated above, gives the force which, acting parallel to the base, (as it always does in the screw,) just balances the relative gravity, and the friction,

$$=\frac{\mathrm{P}\times(\mathrm{H\,I}+n\times\mathrm{G\,I})}{\mathrm{G\,I}-n\times\mathrm{H\,I}},$$

where $\mathrm{P}=$ weight, $\mathrm{G\,I}=$ base, $\mathrm{H\,I}=$ height, and $n=$ the ratio of the friction to the pressure. But in order to express the greatest force which, acting in the direction of the relative gravity, would not drag the body down the plane, H I in the preceding equation, must be taken with the contrary sign from what it is in the equation above, because the force P C, or $\mathrm{P}\frac{\mathrm{H\,I}}{\mathrm{G\,H}}$, or relative gravity, instead of opposing the power, assists it, and the force P M, or $\mathrm{Q}\times\frac{\mathrm{H\,I}}{\mathrm{G\,H}}$ reversed, instead of increasing, now diminishes the pressure which produces the friction, or resisting, force. With this change the greatest force which (acting parallel to the base, and from the summit towards the foot of the plane,) will not drag the body down the plane, will be found,

$$=\frac{P\times(-HI+n\times GI)}{GI+n\times HI}.$$

Let now $HI=\text{rad.}=1$, $n=\cot. a$, as before, and $GI=\cot. z$; z being the angle at the base of the inclined plane, on which, with the given degree of friction, n, the force forward and backward will have the required ratio $f:b$. Then dividing by P, we shall have $f:b::\frac{\cot.a\cdot\cot.z+1}{\cot.z-\cot.a}:\frac{\cot.a\cdot\cot.z-1}{\cot.z+\cot.a}::\cot.(a-z):\cot.(a+z)::\sin.2a+\sin.2z:\sin.2a-\sin.2z$. Then by com. and div. $f+b:f-b::\sin.2a:\sin.2z$, whence the base G I, or circumference of the screw, and thence its diameter may be easily found.

By the diameter of a screw is always meant the arithmetical mean between the greatest and least diameters of the bearing surface of the thread. The screw is also supposed to have a square thread, or at least that the section of its bearing surface with a plane passing through the axis, is a right line, and perpendicular to the axis. But when the thread is in the form of a triangular prism, or rather, when the section above mentioned makes an oblique angle with the axis, the pressure, and of course the friction is increased in the ratio of the sine of that angle to radius, so that $\frac{n}{\text{its sine}}$ must be taken instead of n, through the whole investigation. It is supposed also that there is no pressure except on the threads of the screw; in practice, however, there is almost always a pressure at the other extremity equal to the weight raised, or effect produced, and the increase of power required by the friction resulting from this pressure, is proportional to the mean distance of its action from the axis of the screw. In most of the instruments called vices, or rather wherever the screw acts by tension between the points of action, this pressure is distributed over a circular space surrounding the body of the screw, and the friction thus remote from the axis must absorb a considerable portion of the power; but in the presses, or where it acts by compression between the points of action, it is commonly confined to the extremity of a pivot, and its retarding effect must be comparatively trifling.

Tables showing the results of the preceding investigation, the distance of the same thread after a complete revolution being the unity, C R = 100 in., P = 100 lbs.

Table I.—Showing the circumferences, diameters, radii, and angles of screws, and the proportional powers required for several different degrees of friction.

	n	Bases and Circumference.	Diameters	Radii.	Angle a.		> Min. pwr.		Least power.
Degrees of Friction.	3	$3+\sqrt{10}=6.1623$	1.9615	.9808	18°	26′	9°	13′	6.0437
	2	$2+\sqrt{5}=4.236$	1.3484	.6742	26	34	13	17	2.8559
	$1\frac{1}{3}$	$\frac{4+\sqrt{25}}{3}=3$	.9549	.4774	36	52	18	26	1.4433
	1	$1+\sqrt{2}=2.4142$	.7684	.3842	45	0	22	30	.9276
	$\frac{3}{4}$	$\frac{3+\sqrt{25}}{4}=2$	.6366	.3183	53	8	26	34	.6369
	$\frac{1}{2}$	$\frac{1+\sqrt{5}}{2}=1.618$	.515	.2575	63	26	31	43	.416672
	$\frac{1}{3}$	$\frac{1+\sqrt{10}}{3}=1.3874$	.4416	.2208	71	34	35	47	.306365
	$\frac{1}{4}$	$\frac{1+\sqrt{17}}{4}=1.2808$	.4076	.2038	75	58	37	59	.261075
	$\frac{1}{5}$	$\frac{1+\sqrt{26}}{5}=1.2198$	.3883	.1941	78	41	39	21	.2368
	$\frac{1}{6}$	$\frac{1+\sqrt{37}}{6}=1.1805$	.3758	.1879	80	32	40	16	.2218

TABLE II.—Giving the power for several diameters under each degree of friction, and showing that the diameter given by the formula and the preceding table requires the least power.

	n	Diameters.	Powers.		n	Diameters.	Powers.
Several Degrees of Friction.	3	2	6.04582	Several Degrees of Friction.	½	3	.96
		1.9615	6.04368252			2	.7161
		1.96	6.043686			.52	.416689
		1.92	6.04636			.515	.416672
						.51	.416691
	2	2	2.9339		⅓	3	.68
		1.36	2.8561			2	.52
		1.3484	2.8559			.4418	.3063647
		1.34	2.856			.4916	.3063646
						.4414	.3063647
	1⅓	2	1.9167		¼	2	.4261
		.96	1.43242			.42	.26113
		.9549	1.432391			.4076	.26107
		.95	1.43242			.4	.26110
	1	2	1.3785		⅕	2	.371
		.78	.927765			.4	.23684
		.7684	.92762			.3883	.23680
		.76	.92770			.38	.23683
	¾	2	1.0032		⅙	2	.3347
		.64	.63663			.38	.221784
		.6366	.63662			.3758	.221779
		.63	.63666			.37	.221789

TABLE III.—Which, for the several degrees of friction, shows the diameters of the screws, and the angles of the threads necessary to insure a given ratio between the powers requisite to turn the screw forward and backward.

		Proportion of Forces Forward and Backward.				
	n	3 : 2	2 : 1	3 : 1	4 : 1	5 : 1
Different Degrees of Friction.		5·285. 3° 27′ 3·74 : 2.49	3·152. 5° 46′	2·073· 8° 44′ 5.85 : 1·95	1·709. 10° 33′	1·525. 11° 47′ 8·57 : 1.72
	2	3·953. 4° 36′	2·345. 7° 44′	1·525. 11° 47′	1·245. 14° 21′ 4·619 : 1·55	1·102. 16° 7′
	1⅓	3·285. 5° 32′	1·937. 9° 20′	1·245. 14° 21′	1·004. 17° 35′	·88. 19° 54′
	1	3·051. 5° 46′ 1·224 : ·816	1·855. 9° 44′	1·188. 15° 0′ 1·732 : ·577	·955. 18° 26′	·833. 20° 54′ 2·235 : ·447
	¾	3·285. 5° 32′	1·937. 9° 20′	1.245. 14° 21′	1·004. 17° 35′	·88. 19° 54′
	½	3·953. 4° 36′	2·345. 7° 44′ ·682 : ·341	1·525. 11° 47′	1·245. 14° 21′	1·102. 16° 7′
	⅓	5·285. 3° 27′ ·402 : ·268	3.152. 5° 46′	2.073. 8° 44′ ·513 : ·171	1·709. 10° 33′	1·525. 11° 47′ ·582 : ·186
	¼	6·750. 2° 42′	4·033. 4° 31′	2.668. 6° 48′	2·209. 8° 12′	1·978. 9° 9′
	⅕	8·264. 2° 12′	4·945. 3° 41′	3·28· 5° 33′	2·721. 6° 40′	2·441. 7° 26′
	⅙	9·804. 1° 52′ ·2 : ·167	5·872. 3° 6′	4·91. 4° 40′ ·252 : ·084	3·24. 5° 37′	2·91· 6° 15′ ·281 : ·056

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Wire Ropes on the Inclined Planes of the Allegheny Portage Railroad.

Last year we called the attention of our readers to the successful application of *wire ropes* upon our State railway, crossing the Allegheny mountains. It gives us pleasure to have occasion to add further evidence of their utility, and of their superiority over *hemp ropes,* for the service of inclined planes, whether in point of durability, of efficacy, or of economy. With these remarks, we invite attention to the following extract from the report of John Snodgrass, superintendent of the Allegheny Portage Railroad, to the Canal Commissioners of Pennsylvania, dated December 9th, 1844.

Com. Pub.

"*Ropes for Inclined Planes.*—There are *eight* planes on the Portage Railroad on which hemp ropes are in use, and *two* on which wire ropes are placed."—"*The wire rope on plane No.* 3, has now been running for more than two seasons. At present it exhibits some evidence of 'wear.' However, this rope labored under very considerable disadvantage when first placed on the planes. It being altogether an experiment, it was not supposed that the machinery could be perfected at once. For the first two months before the introduction of the double-grooved receiving sheeve, and while the small iron sheeves were on the plane the injury to the rope from friction was greater than that sustained ever since; the double grooved receiving sheeve, and small *wooden* sheeves having been substituted for those formerly in use, '*the wear and tear*' since has been comparatively small. For what length of time it may yet be competent for the service of the plane is somewhat uncertain; *yet enough has been already ascertained to establish the fact, that wire ropes are much superior to hemp ropes, owing to their greater durability, and the evident economy of their introduction.*"

"*The wire rope on plane No.* 10, was introduced at the commencement of business last spring; it has been in constant use ever since, and at present presents very little injury from wear and tear. I am inclined to believe that this rope will last for at least *three* business seasons, and perhaps for a longer period."

"The principal objection heretofore urged against the substitution of wire ropes for hemp ropes, has been the necessary expense to be incurred in rebuilding foundations of stationary engines. As by the directions of the Board the foundations of the engines at planes Nos. 1 and 6, which, at present, are worked with hemp ropes, will be rebuilt during the present winter; and as the foundation of plane No. 2, was rebuilt last winter, it appears to me advisable to procure wire ropes for said planes."

"The following calculation of the relative cost of *hemp* and *wire* ropes must prove most conclusively the advantage of the introduction of the latter. I take it for granted that a good wire cable will be all sufficient to do the business of any plane on the road for a term of *three* years—probably much longer. Experience has shown that the average durability of hemp ropes is not more than for *one* season. The hemp rope now on plane No. 6, weighed 2.81 pounds to the foot run, which, at 15 cents per pound, makes the cost 42.15 cents per foot. Now Mr. Rœbling proposes to furnish a wire rope, made of No. 14½ wire. (such as is now on plane No. 10,) at 51 cents per foot; or a rope made of No. 10 wire, at 37 cents per foot."

"Presuming the foregoing data to be correct, it will give the following result:—

"For 5,826 feet of *hemp rope*, per season, at 15 cents per pound, ($2,455.65) or, for *three* seasons,	$7,366.95
"For 5,826 feet of *wire rope*, (which will most certainly last *three* seasons,) at 51 cents per pound,	2,971.26
"Saved by the substitution of wire rope on *one* plane,	$4,395.69

"Or $1,465.23 per annum.

"There are yet *eight* planes worked with *hemp ropes*, requiring 41,779 feet of rope. The foregoing statement shows an annual saving, by the introduction of *wire ropes*, of $1,456.23 for every 5,826 feet; (the length of rope required for plane No. 6,) or 25.14 cents per foot. *This will give an entire annual saving, by placing wire ropes on the eight remaining planes, of* $10.503.24."

"One objection heretofore urged against the use of wire ropes on planes, has been the difficulty of attaching cars with safety to the main rope, and also the large number of hemp stops worn out in hitching to it. These objections *have been entirely overcome* by the substitution of an 'iron stop,' invented by John Little, pattern maker in the Johnstown depot. This '*stop*' is a most excellent invention, and its adoption in place of the hemp stops will be a safeguard against any accident in consequence of the '*hitch*' slipping."

"There is a decided advantage in passing cars with wire ropes over and above the economy spoken of, and that is the facility with which cars can be passed in wet weather. The double-grooved receiving sheeves afford sufficient adhesion to draw up any amount of burthen to which the stationary engine power is adequate, while, at certain times, the hemp ropes and single-grooved receiving sheeves are almost useless. My judgment approves of the suggestions made in reference to *wire ropes*, and I am induced to embrace this opportunity of presenting them to the consideration of the Board of Canal Commissioners."

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Modification in the manner of Working Air-Pumps. By O. KEESE.

The following is a sketch of a modification in the manner of working air-pumps, which occurred to me a few days since. It may, very possibly, be in use already; but as I am not aware of its being used, and as it appears to me to combine advantages not found in the common method of rack and pinion, and presuming that it might perhaps be of use to some of your readers, (in case the method is not already known,) I venture to forward to you a description of it. The modification consists in the use of crank and connecting rod, as shown at A A, fig. 1 and 2, instead of rack and pinion, as in the common air-pump. Across the upper part of the piston rods *b b*, are guide pieces *e e*, which move, with the piston rods, up and down in grooves formed in the upright posts D D D, and keep the piston rods perpendicular.

Fig. 1.

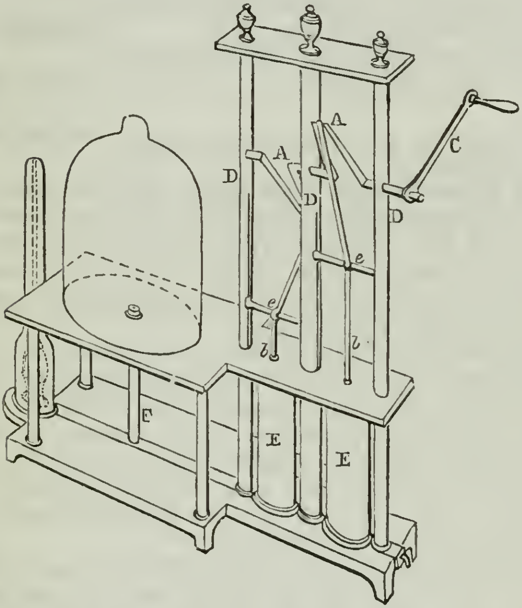
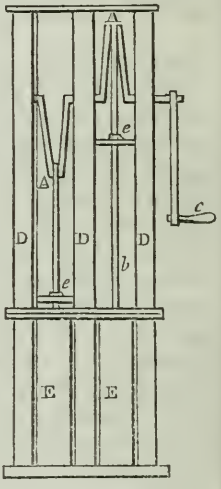


Fig. 2.



It will be seen that by this method the pistons may be made to alternate without that jaring which accompanies the rapid turning backward and forward of the winch in the common method, while, at the same time, the winch C, may be turned constantly forward with greater ease than backward and forward. The barrels E E, the pipes F G, and the remaining parts constructed as in the common air-pump.

Chowan county, North Carolina, Sept. 9, 1844.

NOTE.—It would be an improvement to place the two cranks at right angles,—as this would have a tendency to make the action of the pumps more regular. COM. PUB.

Improvements in Sub-Marine Blasting at Spithead.

Lieut. Barlow, the present executive engineer officer at Spithead, who conducts the operations with no less zeal, intelligence, and activity, than his able predecessors, has tried numerous experiments in the firing of gunpowder by the voltaic battery, partly with the service charges used in breaking up the timbers of the wreck, in tin cans not usually exceeding from 44 lbs. to 55 lbs. of gunpowder, and partly with small experimental charges of a few ounces, by desire of Gen. Pasley, who wished to carry out Lieut. Hutchinson's ingenious plan of firing submarine charges by one conducting wire only, instead of two, (see *Journal*, vol. vi, p. 337,) using the water of the sea to complete the electric circuit. In these experiments Lieut. Barlow first found that it was unnecessary to let down a piece of wire with zinc plates attached to it from the voltaic battery into the water, as had been done by Lieut. Hutchinson, for the circuit was equally good when the wire alone was used; and on repeating those experiments in Gen. Pasley's presence, the correctness of this principle was sufficiently proved, but a difficulty occurred which had not been experienced before, viz., that it required two plate batteries of ten cells each, to fire a charge at a distance of 200 feet, with the single wire, whereas one of Prof. Daniell's batteries of eight cells only, which is inferior in power to a plate battery of ten cells, had always fired submarine charges instantaneously in former years by the double wire, which circumstances had not been adverted to by Lieut. Barlow, as this was his first season. Gen. Pasley, therefore, concluded that the firing charges with one conducting wire, instead of two, might diminish the power of voltaic electricity more than had been suspected last year, when this change was introduced so very late in the season, that there was not time to investigate the result of it in all its bearings; and, consequently, he directed that two conducting wires on reels, the same that had failed in igniting a charge when attached singly to less than a twenty cell plate battery, should be attached to one plate battery of ten cells, on the original principle used at Chatham and Spithead, from 1838 to the middle of 1843 inclusive, so that these two wires, well insulated, connected that battery and a charge at the bottom, without trusting to the water. On adopting this arrangement, instantaneous explosion took place as soon as the circuit was completed. Thus the double metallic circuit was proved to be the best for firing gunpowder, whether underground, or under water, and will as such be exclusively used in all future explosions; though for the purposes of an electric telegraph, which requires wires to be laid for many miles, and which needs infinitely less power than is necessary for the firing of gunpowder, water, or moist earth, especially the former, may be used to advantage for completing the circuit, in combination with one wire only, extending the whole length of the telegraphic line. Civ. Eng. & Arc. Journ.

TRANSLATIONS FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Solar Tides.

Extract of a letter from *Mr. Airy* to *Mr. Miller*.—"I beg you to present my best compliments to M. Arago, and to inform him that I have discovered a position on the west coast of Ireland, where the solar tide is greater than the lunar, although upon each side of this peculiar locality the solar is (as usual,) the smaller tide. This position is near a *node*, and the place of the node is not the same for the solar and lunar tides. A six-hour tide, *(marèe quarto-diurne,)* which shows itself perceptibly in my discussion of all the tides of the environs, is not influenced by this node, and, consequently, becomes, under ordinary circumstances, the most striking phenomenon; taking all things into consideration, it is the strangest thing that I have ever seen.

Compte Rendus des Seances de l' Academie des Sciences, 16 Sept., 1844.

Printing in Colors by the Typographic Process.

M. Silbermann, a printer at Strasbourg, presented several specimens of printing in colors, obtained by the aid of the ordinary typographic press. One of these specimens is taken from an impression of two thousand five hundred copies, "all of which," says the author of the letter, "are perfectly identical with each other; and, after leaving the press, required no re-touching." This little picture, which presents twelve different colors, was printed by means of a single plate, while, in the ordinary process of polychromatic printing, as many plates are employed as there are distinct colors. Ibid.

Optical Solar Spectrum.

M. Matthiessen presented a memoir, entitled "Memoir upon the optical solar spectrum; upon the improved lentiprism; upon the absorption of the new extreme violet by different substances; upon the elementary composition of the solar spectrum; and upon the structure of the eye. "I present," says the author, "drawings of the solar spectrum, as seen by my improved lentiprism, which is extended beyond the extreme red of the spectrum of Fraunhofer, and adds to it an extreme violet, equal to three-fourths of the whole optical spectrum hitherto known. This new violet part of the spectrum is covered by a great number of obscure rays remarkable, for the most part, for their regular disposition in groups." Not only do the instruments of M. Matthiessen increase the breadth of the spectrum beyond the photogenic impressions, hitherto obtained upon substances chemically sensitive, but they besides show groups of distinct rays, where the iodized plates produce only dark and shaded bands. Ibid.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE

State of Pennsylvania

AND

AMERICAN REPERTORY.

APRIL, 1845.

CIVIL ENGINEERING.

Connecting-Crank. By ELIJAH GALLOWAY.

This machinery, or apparatus, for connecting two shafts so as to cause the same to revolve at different velocities, is illustrated somewhat in the following manner:—

Let *a b*, fig. 1, represent the pitch line of two wheels, the wheel *a* being twice the diameter of the wheel *b;* then for every revolution of the wheel *a*, the wheel *b* will make two revolutions, and if a tracing point be attached at *b'*, it will describe the straight line *a a'* upon the face of the larger wheel, and if another tracing point be attached at the opposite side of the small wheel *b*, such points will describe straight lines at right angles to one another during the revolution of such wheels.

In fig. 2, is shown an elevation of the arrangement of levers for connecting two shafts together, so that they may revolve at different velocities. Fig. 3, is a plan of one of the shafts which is provided with a crank forming a portion of the apparatus. In fig. 2, *a* is a crank, fixed upon the end of a shaft *b*, supported by suitable bearings; *c* is the crank pin which supports the triangular arm *d*, through each end of which there are pins *e e*, in the same plane with the aforesaid shaft, these pins support two connecting rods *f g*, the lower end of the connecting rod *f* being attached to the crank *f'*, shown in the plan, the lower end of the connecting rod *g* being attached to the crank pin *g'* of the plan; *b* is a pin fixed into the end of the shaft which carries one end of the connecting link *i*, the opposite end being attached to the centre, or middle, of the connecting rod *e*, by the pin *j*; *k* is the axis of the shaft which is to receive motion from the shaft *b*, or *vice versa;* consequently, if *g* be double the length of the connecting link *i*, the point *g'* will describe a straight line *l l*, and if we suppose *g* to be attached at its lower end to the crank pin *g'*, and also the rod *f* to the crank pin *f'*, and that the axes *b* and *k* revolve in suitable bearings, *k*, will make two revolutions whilst *b* makes one revolution.

Fig. 2.

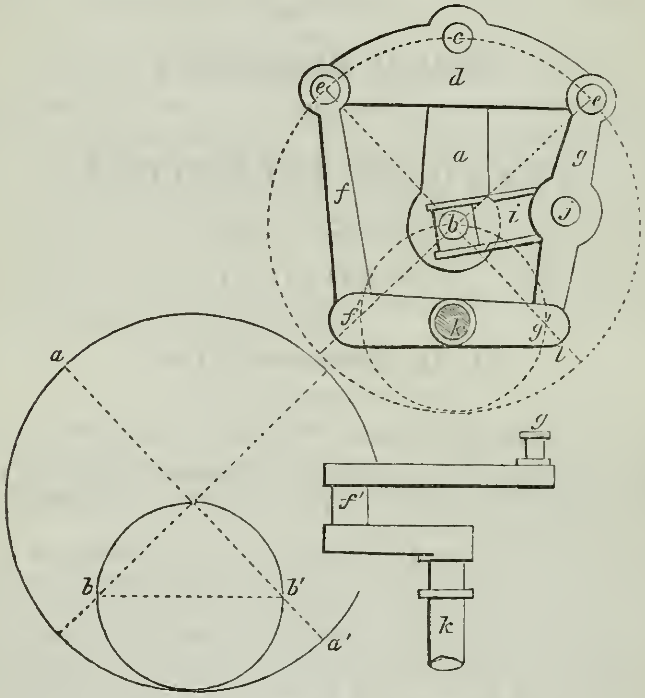


Fig. 1. Fig. 3.

There are other modifications of the above apparatus shown, for which the inventor claims machinery described for connecting axes, or shafts, to revolve in connexion at different velocities.

Civ. Eng. and Arc. Journ.

Accident in a Spinning Mill at Dundee.

An accident happened in this town last week at one of the spinning mills, attended by serious consequences; a young man having lost his life, and the person that attended the engine, and several others being severely hurt. The accident occurred in the following manner:—After the engine was started in the morning, and before the machinery in the mill was connected, it got off at full speed, and the motion was accelerated to such a degree, as, from the centrifugal force it had acquired, to break the fly-wheel into a great many pieces before the fireman could stop the engine. The broken pieces of the ring and arms flew in all directions through the side walls of the engine-room, and also through the ceiling above. After the accident it was found on examination that the throttle valve was broken in two pieces, and was, consequently, rendered useless as a regulator. To prevent the recurrence of accidents of this nature, a very simple contrivance might be adopted, which is as follows:—Place an additional valve in the steam pipe between the boiler and the engine, as near the latter as possible; let this valve be wrought by an apparatus connected with the governor, so arranged that when the engine exceeds its *fastest* speed the governor balls, by their centrifugal force, would act upon the apparatus so as to shut the valve. This might be effected in various ways, and would prevent the engine from attaining such dangerous degrees of speed.

The common throttle-valve and governor is certainly a most admirable and efficient contrivance; but in cases like the present, when the valve happens to break, the governor loses all control over the engine. At this moment, the above-mentioned appliance would come into action, and check the engine in time. It is not uncommon to have a separate shut-off valve of this description applied to engines to be wrought by hand by the engine-man, and it is found to be a very convenient way of regulating the motion of the engine until the belts, &c., are put on, and the engine has its regular work to perform. All that I would suggest is, that this valve should be connected with the governor, or otherwise, so as to be *self-acting* when the ordinary throttle-valve is disqualified for performing its proper duty, which might happen when the fireman was negligent, or absent from his post; but it is easy to perceive that, independent of these contingencies, very little time indeed is sufficient to allow the engine (especially if in good working order, and lightly burdened,) to attain such a high velocity as to work destruction before the fireman could get it checked. The accident at Dundee is a verification of the truth of this remark. The poor fellow that lost his life was struck by one of the pieces of the fly-wheel when in the act of running from the lower flat of the mill to convey intelligence of the accident to the fireman; and sufficient time had not elapsed to afford an opportunity of shutting off the communication between the engine and boilers, by the valves generally placed on the top of the boilers for this purpose. Certainly, the ordinary way of stopping the engine might have been resorted to, viz., to throw the eccentric rod out of gear; but this was not done in time nor would it be likely to be attended to in most cases of this nature.

I may mention, in conclusion, that the engine was of twelve horse power. The fly-wheel had been found deficient in weight, and in consequence pieces were put on the ring to increase the momentum of it. The original ring was cast in six pieces, or segments, and held together by the arms, which were cast in one piece, overlapping the joints, and secured by bolts. On examining the fractures it was evident the arms had broken first across where they joined the ring. In measuring the section of this part of the arms, and calculating their ultimate strength by Tredgold's rules for the strength of cast-iron, the centrifugal force, or tensile strain, must have exceeded 30 to 35 tons on each of the arms before they had given way. The wheel was 12½ feet in diameter, and sufficiently strong, even with the enlarged ring, to withstand the strain upon it while the engine moved at its ordinary speed; this was proved by the experience of a considerable number of years. C.

Dundee, 25th December, 1844.

Glasgow Mechanic and Engineer's Magazine.

Locomotive Engine Explosions.

We have to record the occurrence of the *second* important explosion of a locomotive boiler—for we reckon the boiler of the iron steamer Telegraph, a locomotive boiler in all essential respects—that has occurred in this country. It took place on the 11th ult., upon the Dover Railway, with the engine "Forrester," in connexion with a goods train of twelve luggage wagons, on its way to Dover. It is stated that two successive explosions took place, the second one being of by far the greater force. As soon as the steam and smoke had cleared away, the line was found to be completely blocked up with wagons, which were spread across the whole line, and piled on each other; the engine had gone over the viaduct, and was partially buried in the earth beneath, whilst the tender was hanging over the side of the viaduct, torn and folded together like paste-board, its carriage having fallen about twenty yards from where the engine lay. The engine-driver was found dead; the stoker was found nearly dead, with the whole of his jacket, except the cuffs, blown off his back, and was conveyed to Guy's hospital. A strict examination into the circumstances of the accident was instituted, and the result is shortly as follows:—

The bursting of the locomotive being the supposed cause of the accident, their first object was to examine the engine as it lay imbedded in the earth. After getting off the viaduct it had pitched head foremost into the earth a depth of four feet, and then turned over. They found the fire-box was blown out, as well as the fire-bars, and the inner casing, between which and the outer casing the steam generated, were also torn away. The next point was to examine what effect the explosion had upon the viaduct, and the probable cause of the engine getting off the line. They found that there had been two explosions—the first apparently took place about eighty feet from the spot where the engine was lying. The fire-bars at the bottom of the fire-box had been blown completely through the viaduct into arch No. 134, making a hole three or four feet square. The second explosion, the more severe of the two, not only blew the fire-box through the arch No. 133, but such was the force of the steam, that the engine "jumped," and descended partly on the rails, and partly off, a distance of eight or ten yards, crushing the immense pieces of timber that supported the viaduct. It was deposed by Mr. Bury, of the firm Bury, Curtis & Kennedy, the makers of the engine, that he could account for the explosion only by the excessive pressure of the steam, arising either from want of freedom of the safety valve, or from a deficiency of water in the boiler.

Ibid.

Description of several WATER-WHEELS *called* "TURBINES," *exhibited at the Exposition de l'Industrie Française, at Paris.*

Knowing the earnest desire of the scientific public for information, and the interest which attaches to French ingenuity and mechanical skill, we have availed ourselves of the valuable reports of M. Burat, C. E., to give an account of some of the most remarkable and interesting objects exhibited at the recent Exposition de l'Industrie Française, at Paris. A feature quite novel to us is the number of turbines exhibited, a class of machine, of which, we believe, no specimen exists in England, and of which the only description is a slight sketch by Mr. George Rennie, C. E., who has not, however, introduced any mention of it in his edition of Buchanan's Millwork. In France, however, we suppose that at least a hundred must be now in operation, and they must undoubtedly be successful, or they would not so early have secured the patronage of a class so prejudiced as the French millers.

Hydraulic Machines.—Not the least interesting section of the Exposition was that devoted to hydraulic apparatus. The *rapporteur*, in introducing the subject, says—"Many people imagine that the first cost and fitting up an hydraulic motor are less than those of a steam engine. What has had a great influence in propagating this error has been that the establishment of hydraulic motors generally took place under such unfavorable conditions, and on such a defective system, that the first expense was diminished at the expense of the power of which only a third, or fourth, was utilized. When, however, we calculate, beyond the purchase of the right of water, and the adjoining ground, the construction of dams, head of water, mill race, and wheel well made, we shall find that for an equal amount of power, the fitting up of a steam engine is less expensive. The advantage, however, of hydraulic motors is, that though the cost of establishment may be considerable, the cost of maintenance is next to nothing, and the charge only the interest of the money laid out." It is calculated that the amount of water power utilized in the factories of France is equal to 20,000 horse power, though from the bad construction of the machinery it is supposed to be under estimated, and that the real power of the water is at least double.

Many endeavors have been made by men of science to improve this state of affairs, and latterly, a great deal of attention has been directed to the turbine. Under the general name of turbine are included water-wheels formed on very different principles, and which have nothing in common but the property of all turning on vertical shafts. M. Burdini, mining engineer, first imagined and made known, under the name of turbine, machines which received the water in the upper part of a vertical cylinder, or drum, and eject it from the lower part; the water is guided by vertical channels in the rim of the drum, which must have a height equal to half the entire height of the available fall of water.

M. Fourneyron has occupied himself a good deal with turbines, and the model of one erected at the mills of St. Maur, near Paris, was exhibited. In Fourneyron's turbine the drum is always made rather narrow. The water glances obliquely in horizontal jets on the whole contour of an internal vertical cylinder, and penetrates in every direction the compartments of the wheel, which, in turning, just touches this external cylinder, and follows by passing the curved buckets, or chambers, enclosed in the horizontal bases, and escapes horizontally from the external rim of the drum.

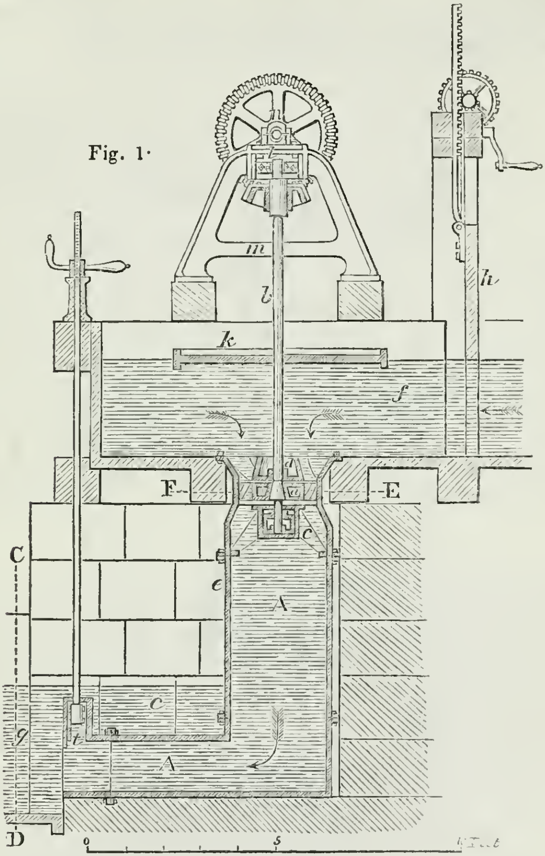
The construction of turbines suggests the most complicated problems of hydraulics, and theory has not yet afforded the means of solving them *á priori;* practice alone gives any solution at present. The greatest difficulties in the turbine are in the details of execution. The water to produce the maximum effect must enter without shock, and leave without velocity. M. Fourneyron has constructed several turbines, but he has not made known the proportions which he gives to them. From the experiments of M. Savœry, it was established that even with falls so slight as one foot, up to 3, 10, 15 and 25 feet, the disposable work transmitted by the turbine reached from 7 to 8-tenths of the motive power.

Turbines, of all hydraulic wheels, are those which under the smallest volume of water utilize the greatest quantity. The water which propels them does not press on the axis. The high and variable speed which can be given to them, without sacrifice of power, allows the abandonment, in many factories, of a quantity of mill work and heavy spindles, for the purpose of accelerating the movements. Another property of the turbine, and perhaps the most important, is that of working when it is completely immerged in the stream a fraction of the absolute power at least as great as when working above. This allows, at all times, the whole fall of a stream to be turned to account. From this property, M. Arago has conceived the plan of establishing a complete system of turbines on the Seine, in order to provide for the supply of water to Paris.

M. Fontaine Baron has sent to the Exposition a turbine of 18 h. p., which much resembles that of M. Fourneyron, though differing in some details, and particularly in the direction given to the chambers, or buckets. M. Fontaine, who lives at Chartres, has already constructed thirty or forty in that part of France, where the corn trade is a principal one. M. Taffe has frequently applied a register to M. Fontaine's machine, and certified the useful effect to be seventy-nine per cent.

Kœchlin's Turbine.—M. A. Kœchlin also exhibited a turbine patented by him, the construction of which consists of two hollow conical centres surrounded with helical blades *a* and *d*, the upper one *d*, is fixed, and serves as a guide for the flow of water on to the blades of the lower one *a*, called the turbine; by the force of the current the water causes the turbine to revolve, and with it the vertical shaft on which it is keyed, and the beveled wheels above. Both the fixed and movable turbines are placed within the mouth of a tube, the orifice of which is contracted in such a manner as to allow the proper quantity of water to pass through, that is due to the velocity arising from the difference of two levels of water above and below the turbine. The advantages of Kœchlin's turbine are, that the turbine may be placed at any point taken in the height of the fall according to

Fig. 1·



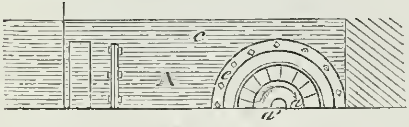
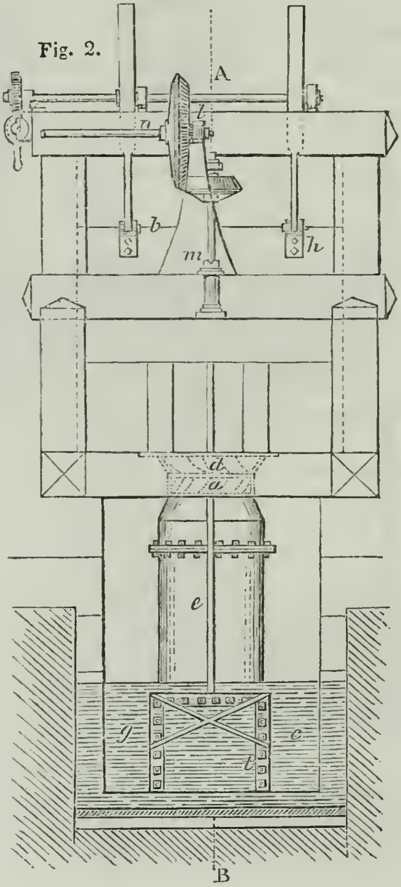


Fig. 3.

circumstances, the inferior column may be prolonged at will. Also, the action of the water acts simultaneously by the pressure of the inferior column, and from this combination the inventor has called his machine the double-acting turbine. This system of construction offers advantages which will be appreciated by those who are aware of the great expense of mill work for foundations.

Fig. 2.



It is sufficient for these turbines to place below the surface of the lower level the conduit for conveying the descending current, with a regulating sluice at the end, and to fix the stay block which receives the arbor, or point, of the shaft in the interior of the tube at the most convenient height, taken between the surfaces of the two levels. In this manner it is always easy instantaneously to run the wheel dry, and so keep it underhand. The turbine is also provided with a sluice for its supply, and when it is required to be put in motion it is opened to give passage to the water, and the receiver is first allowed to be filled completely up to above the turbine, when the discharge sluice is opened, and the water allowed to flow out in quantity and relation to that of supply, so that the column within the receiver is always kept to one level.

Reference to the Engravings.—Fig. 1, vertical section of the turbine through A B, of fig. 2. Fig. 2, transverse elevation taken through C D, of fig. 1. Fig. 3, horizontal section through E F, of fig. 1. The same letters are used for the same parts in each of the three figures.

a, water-wheel called the turbine; *b*, shaft of the turbine; *c*, block, or step, supporting the axis *b*; *d*, guide, or *fixed turbine*, supplied with helical curves which serve to give to the fluid vein the desired direction; *e*, case of the turbine; *f*, upper channel; *g*, lower channel; *h*, sluice of the canal *f*, to regulate the flow to the turbine; *i*, sluice of the canal *g; k*, float; *l*, upper collar of the shaft *b; m*, support of the collar *l; n*, bevel wheels and shaft of transmission, supported by another collar, which, like the former, is secured to the support *m*.

Fig. I, represents the water of the upper channel *f*, in communication with the lower channel *g*, passing through the guide *d*, the turbine *a*, and the case *e*, which may properly be called the channel of junction. It is by passing through the turbine *a*, that the water impresses on it a rotary movement in the direction indicated by the arrow *a'*, figure 3, a direction which would be inverse if the guides, as well as the vanes, of the turbine were inclined in the opposite direction.

Passot's Turbine.—M. Passot also exhibited one of his turbines, (see figures 4 and 5,) the construction of which is founded upon using reacting wheels, and produced by the effect of centrifugal force. They are composed of cylindrical vessels fixed to vertical arbors, and supplied at the circumference with orifices intended for the introduction, or ejection, of the water. The modification which M. Passot has introduced into the old reacting wheels, and which he claims as his invention, consists of having suppressed, or got rid of, the internal partitions, and reduced the old wheels to their only true essential elements—a motive cylinder to contain the motive fluid, with surfaces to receive its action, and corresponding orifices for discharge. The surfaces and the orifices are exactly included between two concentric circumferences, that is to say, that he carefully retrenches all other surface, or projection, capable of impressing the water with the angular movement of the wheel before having reached the parts destined to receive its action, as well as the orifices of discharge. "I form the new wheel," says M. Passot, "simply by placing either in the interior, or exterior, of a cylindrical drum, according as I want the pressure of the fluid to be exerted on the interior, or exterior, curved vanes in the arc of a circle, such as *a b c d*, figures 6 and 7, then I make orifices of discharge, by removing from these vanes and from the cylinder the part in form of a wedge, *a b d*, and the motion is effected by virtue of the pressure on the faces *c d*, *c' d'*, *c'' d''*.

"While the machine is very simple, its properties are very remarkable. When the wheel turns without load, or work, under a given difference of level, or fall, its vanes take exactly the theoretical velocity due to the fall. It is no longer the same when in any manner the form of the new wheel is altered so as to approach those formerly known; all partitions, projections, and asperities which are either

Fig. 5.

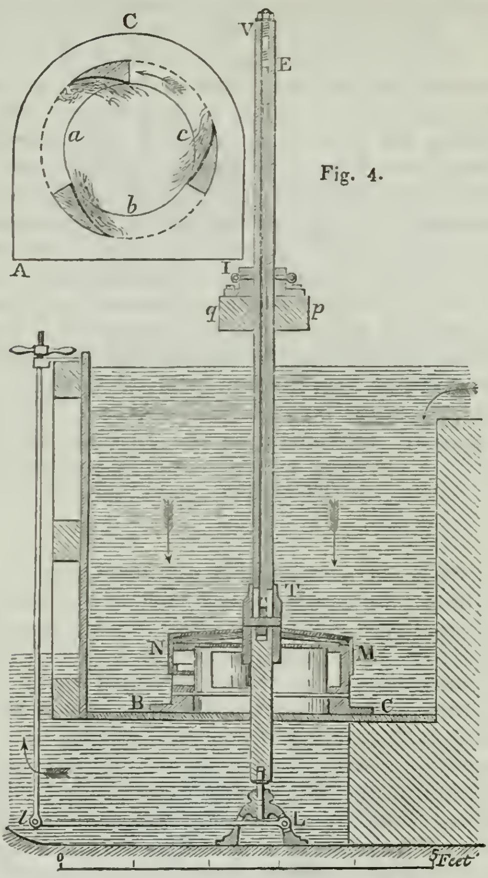


Fig. 4.

Fig. 6.

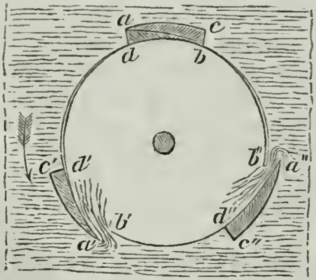
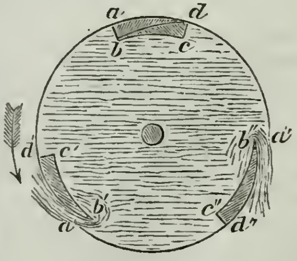


Fig. 7.



within, or without, two concentric circumferences, considerably diminish the theoretic velocity of rotation due to the fall, on account of the continual shock of these bodies in motion against the water in repose. Then it is not surprizing if the useful effect of reacting wheels when experimented upon has never risen above fifty per cent., that is to say, about the rate of breast wheels of the usual varieties.

"The expenditure of water in figure 7, with the internal action, is sensibly independent of the greater or less reaction of the wheel. In figure 6, with external action, this cannot take place on account of the counter pressure arising from the formation of an eddy in the interior; but this counter pressure is, however, much less than might be supposed. I have demonstrated that when a fluid forms an eddy in the interior of a cylinder, the effects of the centrifugal force show themselves differently according to the different inclinations of the projections, or orifices, made on the circumference.

"In No. 1, the orifices are disposed in the direction in which the centrifugal force can least influence the expenditure of water. Thus the coefficient of theoretical expenditure due to the work, during the experiments on the turbine, which I constructed at Bourges, has been found very little different from that which agrees with the openings of ordinary sluices disposed so as to avoid contraction on three of the sides. The wheel which turned in work, with about half the velocity due to the fall, and the coefficient was 0.70 to 0.79."

Explanation of the engravings of Passot's turbine, *a b c*, figure 5, plan of the wheel. A B C, fixed base of cast-iron. M N, cover acting as a sluice to regulate the expenditure of water. *p q*, block of wood carrying the step of the arbor, or shaft. E V, male and female screw, serving to regulate the cover by means of the rod T *t*, passing through the hollow shaft. L *l*, lever to raise the whole motive system by means of the pivot.

M. Poncelet, adopting an arrangement the reverse of that of M. Fourneyron, has proposed a system of turbines of the nature of the horizontal wheels used in the centre and south of France. The water enters by a spout placed on the outside, stretches the vanes, and is discharged by two openings made towards the centre. M. Cardelhac has constructed at Toulouse turbines on this plan, and Messrs. Mellet, and Sarrus, of Lodeve, have exhibited one with the same arrangement. The principal part of their turbines consists in a case of particular form, provided with three openings, of which one is for the water to enter, and the two others to allow it to escape after its action on the wheel. In consequence of the spiral form of this casing, the water arrives on the wheel placed in the interior without any shock, and with a velocity due to half the height of the fall. Each of these veins, or streams, of water acts at the same distance from the axis, as if it were isolated and independent of the other; its velocity is transformed into pressure by insensible degrees, and without any loss of power. Messrs. Mellet and Sarrus have already put up several of these turbines in the south of France with good results. They come cheap, one for an ordinary grist-mill costs 40*l.*, one of 12 or 20 horse power, well finished, and of good material 120*l.*

There was at the exposition another hydraulic machine, which the maker, M. de Lamolere, calls a piston wheel. This machine receives water like a breast wheel. The water brought by means of a plunging fan, falls into a bucket, where it stretches a wooden valve, fitted with leather. It passes through this valve, which is followed by a second also. These successive valves turn horizontal shafts, which then give movement to the factory.

Civ. Eng. & Arc. Journ.

AMERICAN PATENTS.

List of American Patents which issued in the month of August, 1844, *with Remarks and Exemplifications. By* Charles M. Keller, *Examiner of Patents.*

1. For improvements in *Tanneries, and the Handling of Hides;* Wm. Brown, Manchester, Carroll county, Maryland, August 1.

Claim.—"What I claim as my invention, is constructing the leaches and vats so that the liquors pass through the top strainer of one leach into the bottom of the next throughout the circuit, or direct to the pump, and are returned from the vats, after being heated, to the bottom of the leaches, and in combination therewith the arrangement of tanks, stocks, and spiggots, by which I effect these objects. I likewise claim the revolving rollers of the tanning and liming frames for accommodating the hooks to the shrinking of the hides, and the manner in which I arrange the two shafts, connected and operating as described, for working the tanning and liming frames to which the hides are suspended, and in combination the reels and shafts for handling, baiting, and washing; likewise the manner in which I arrange the railroad and car, with respect to the mill, and the leaches by which the bark is conveyed direct to the leaches, and deposited therein."

The leaches are provided with perforated false bottoms, on which the hides are placed, so that the liquor can be admitted from below by means clearly indicated in the claim. They also communicate by means of hollow trunks, with the vats, &c. The tanning and liming frames are provided with rollers armed with teeth, to which the hides are attached, and which yield to the shrinking. These frames are hung to arms projecting from shafts so linked together, and connected with a crank shaft that, as one descends the other rises, and vice versa. The reels to which the hides are suspended in the vats are operated by hands extending from a rocking shaft, also connected with a crank shaft, by which the handling, baiting, and washing are effected. Above the four leaches, which are arranged around the shaft of the bark-mill, there is a circular railway with a car to receive and convey the ground bark to any of the leaches, the car being provided with a drop bottom, and a catch, by which it can be attached to, or detached from, an arm on the mill shaft.

2. For an improvement in the *Scrubbing Brush;* George Carver, Chambersburg, Franklin county, Pennsylvania, August 1.

The handle of the brush is connected with the block by means of a pin joint to secure an equal bearing of the brush on the floor, and insure its wearing equally, instead of at the edges, as when the handle is fixed.

Claim.—"What I claim is the application of the joint and hinge to the scrubbing brush and block, whether in, on, or at the side, so as to operate in the manner and for the purpose described and set forth."

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3. For improvements in machinery for making *Wrought-Iron Butt Hinges;* Cyrus Kenney, Troy, Rensselaer county, New York, August 7.

In the making of butt hinges of wrought-iron, the two halves are cut from sheet-iron plates, by machinery for that purpose, with projecting pieces from which the knuckles are to be formed; these projecting pieces are first partly bent by one operation, and then completed by a machine, patented some years ago by a Mr. Rouse. The first of these bending operations is effected under this patent by an arrangement consisting of a rest-die attached to the bed of the machine, and two dies and a gauge attached to one end of a working lever. The face of the gauge is at a distance from the inner edge of the rest equal to the space between the end of the tongue on the hinge plate, and that part where the bending is to be commenced, and the two dies are attached to the lever, forward of the gauge, one of them to strike the metal between the gauge and rest, and the other immediately over the rest. The knuckles after being completely bent, which operation elongates them, have to be trimmed off, or up-set, and the second improvement under this patent, is to effect the latter object, which is done by means of two dies, one permanent and the other sliding, the space between the two, when nearest to each other, being equal to the required length of the knuckles. These dies are grooved and mortised to receive the flaps of the hinges, and thus bring the knuckle to be upset between the faces of the dies; there are also mortises in the dies to receive the knuckles that are not being upset.

Claim.—"What I claim is the method of bending the ends of the projecting pieces which are to form the knuckles, by combining the rest, dies, and gauge, under an arrangement substantially as set forth, and so as to adapt them to the partial formation of the knuckles of the butt hinges. I also claim the method, herein described, of upsetting the knuckles of the butt hinges, by providing the pressing dies with grooves and mortises, or openings, to hold the flap and receive the knuckles, for the purpose and in the manner described."

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4. For a *Corselet for Curved Spines;* Alanson Abbé, Roxbury, Norfolk county, Massachusetts, August 7.

This corselet is made of iron and other appropriate material in two parts, one adapted to the shoulders, the other to the hips, the two being connected together by an elastic strap along the middle of the back, or spine, so that the position of the two can be changed at pleasure.

Claim.—"What I claim consists in the described mode of making the back of a corselet, viz., in constructing the same of two parts, and jointing them together, and otherwise arranging them with respect to each other, as set forth, and connecting them by an elastic strap, or straps, or other proper elastic materials, which have, or have not, means of increasing their elastic force, the whole being substantially as specified."

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5. For an improvement in *Lamps for Light-Houses;* Winslow Lewis, Sr., and Benjamin Hemmenway, Roxbury, Norfolk county, Massachusetts, August 7.

These improvements are adapted to the kind of argand lamps employed in the light-houses of the United States; and the first consists in making the inner tube of the burner in two parts, the upper part being a ferule slipped on to the main body of the tube, so that when injured by the action of the flame it can be removed, and another substituted; and the second improvement is for an arrangement to support the chimney by means of brackets attached to the outer tube o the burner at sufficient distance apart to admit of turning the wick by a milled rim attached to the ferule which carries the wick tube.

Claim.—"What I claim is as follows, viz., a movable cap, or ferule, applied to, or slipped upon, the inner air tube of the burner for the flame to act upon, instead of the top of the inner tube, as heretofore arranged; also the above described mode of sustaining and arranging the supports of the glass chimney, with respect to the tube, and milled rim thereof, by which, in connexion with the other mechanism, the wick is elevated and depressed; the ordinary kind of glass holder being thereby dispensed with, and the wick raised and lowered without turning the chimney, or lamp glass; thus preventing the chimney from being smoked on one side, or its interior surface, as often takes place in lamps where it is supported upon a glass holder as ordinarily constructed; the whole of the above being substantially as explained."

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6. For a machine for *Rolling Irregular Figures to a Pattern;* William Field, Pawtucket, Providence county, Rhode Island, August 7.

This is for a modification of the rolling mill, and consists of three rollers arranged one above the other; the bearings of the bottom one being permanent, the upper one movable, and provided with set screws for adjustment, and the third, or middle, one movable up and down between the other two, the upper and the lower one being geared together to insure their moving with equal velocities. A pattern of a wedge-like, or other desirable form, is placed between the middle and upper roller, and the piece of metal to be rolled between the middle and lower roller, from which arrangement it will be evident that the pattern in passing through will, by its irregularities, cause the space between the middle and lower rollers to increase and decrease, and thus give the desired form to the article to be manufactured, provided the passage of the metal to be rolled be carried through with the same velocity as the pattern.

Claim.—"What I claim is the employment of the rollers combined and arranged in the manner and for the purpose set forth, in combination with the pattern, for the purpose described."

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7. For improvements in the method of making *Vessels of soft metal,* such as are used for containing pigments for artists, &c.; John Rand, a citizen of the United States, now residing in England, August 7.

The patentee says,—"My invention relates, first, to a mode of forming thin metal vessels of metal tin, and other metals sufficiently malleable to be operated on by the process of pressing the same into the depth of vessel desired; and secondly, my invention relates to a mode of making a screw on the neck, or nozzle, of metallic vessels, and also the mode of making screw caps."

Claim.—"I would have it understood that I do not confine myself to the precise details shown, provided the peculiar character of my invention be retained: but what I claim is, first, the mode described of making soft metal vessels by causing a thick piece of metal to be pressed in the required form, by pressure of dies as is described; secondly, I claim the making a screw by pressure in dies on the necks of metal vessels; and thirdly, I claim the making of metal screw caps by pressure, as described."

The method covered by the first section of the claim, is to place a piece of soft metal in a matrix, of the form of the intended vessel, but of less length, and to make pressure on it by means of a metallic follower of the form of the inside of the intended vessel, which will force the metal out of the matrix, cause it to form around the follower, and to assume externally the cylindrical form of the matrix. The method of making screws on the necks of soft metal vessels, is to place the end of the soft metal vessel within a die having the form of the intended screw, and then forcing a conical die within the neck which forces the soft metal into the threads of the matrix; and the method of making screw caps, covered by the third section of the claim, is the reverse of the preceding method.

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8. For a machine for *Turning Scythe Snaths, or Handles,* and other similar articles; James Ombree, Marshalton, Chester county, Pennsylvania, August 7.

The timber is first prepared and reduced to an approximate form by a saw-mill with a double carriage—the lower one in the usual manner of saw-mill carriages, and the second, or upper, one resting on the first and moving longitudinally with it, there being a roller at each end of the second carriage bearing against transverse ribs projecting upwards from the first, or lower, carriage, to prevent the upper one from moving lengthwise, but to admit of lateral play. The upper carriage is provided with clips near each end which embrace a guide of appropriate form, so that the saw, which is operated in the usual manner, shall cut the timber of the form required.

The piece of timber thus prepared is presented to the turning instrument by means of two parallel feed rollers, and two guides parallel with each other, and at right angles with the axis of the feed rollers; the two rollers are kept in their parallel relative position by means of links, in the manner of parallel rulers, and the two guides in the same manner, and these two sets are so arranged and connected with levers, that by means of weights attached thereto they always gripe the piece of timber.

The cutting instrument is attached to a hollow chuck, through which the piece of timber to be turned passes, the cutter projecting inwards, and as scythe snaths, and the other articles intended to be turned, are of a regular taper, it is necessary that the cutter should have a regular movement towards, or from, the centre of the wheel from the commencement to the end of the operation, which is effected by having the chuck which holds the cutter made in two parts, one turning on the other, the cutter sliding in the inner part, and being connected with an eccentric groove in the outer one, which moves the cutter in or out, as the two parts turn on each other, and to effect this the two parts are connected together by gearing in such manner that, as the whole chuck rotates with great rapidity the two move on each other with a very slow motion, the difference between the two giving the necessary motion to the cutter. There are three guides, or rests, which correspond with and move in like manner as the cutter.

Claim.—"What I claim is, first, the manner in which I have arranged and combined the apparatus for sawing the stuff to the proper curvature, said combination consisting of the first carriage, the second carriage with its friction wheels, the curved guide strips, and the clips with thin cylindrical stems received within holes in the ends of the second carriage, substantially as set forth. I also claim the manner of arranging and combining the two parallelograms in which the vertical guide pieces, and the toothed feeding rollers, are made to embrace, conduct, and direct the handle to be turned through the opening in the wheel, or chuck; the feeding rollers being made to revolve, and the other parts of the parallelograms being acted upon and governed as described. I claim the combination and arrangement of the parts employed in causing the cutter and guides to approach and recede from the centre of the wheel (chuck) during its rotation, as described."

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9. For an improvement in the machine for *Winnowing Grain;* Thomas Cole and John Littlefield, Allensville, Switzerland county, Indiana, August 7.

In this winnowing machine the fan is made with inclined vanes to throw the current of air in the direction of the shaft;—it is directed towards the middle of the screens by means of two vertical and oblique wings attached to the frame between the fan and the screens. The grain passes from the hopper through two shaking horizontal screens, one above the other, and from the latter of these on to another which is inclined and permanent, the lower end of which discharges the grain into the upper end of a fourth and last that is inclined and rotating.

Claim.—"What I claim is, first, the arrangement of the wings in the manner and for the purpose set forth; second, the combination of the permanent inclined rectangular screen with the revolving cylinder screen as set forth."

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10. For an improvement in the *Truck Frames of Railroad Cars;* Charles Davenport, Cambridgeport, Middlesex county, Massachusetts, August 10.

The connexions between the pedestals of this truck frame instead of being made by means of solid pieces of timber extending from one pedestal to another on each side, are, by means of two tie plates of iron bolted together through the pedestals, one being above, and the other below; above the upper tie plate, and extending from one pedestal to the other, there is an arch plate connected with the pedestals by the same bolts that secure the tie plates. The two truss frames are connected together by means of diagonal iron plates bolted to the pedestals, and so twisted and connected in the middle as to form the opening for the king-bolt that secures the truck and car together.

Claim.—"I do not claim making the truck frame of a railroad carriage with side truss frames united with diagonal braces, as this has been known before, nor do I claim making these frames of iron, or other metal; but what I do claim as my invention, is making the trusses of the truck frame that are united and braced together by means of twisted diagonal plates, of arch plates, and tie bars, so arranged and bolted together as to embrace and secure the pedestals as described, by which arrangement I obtain the necessary strength with greatly reduced weight, and employ the pedestals for the double purpose of holding the boxes of the wheel axles, and connecting the tie bars of the trusses."

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11. For improvements in the process of manufacturing *Iron, Steel, Copper,* and other metals; Arthur Wall, Poplar, Blackwall, Great Britain, August 10, to run fourteen years from the 18th of November, 1843, the date of the English patent.

The first part of this invention consists in adding to the iron, while in a state of fusion in the smelting, puddling, balling, or reheating furnaces, certain compound masses, which the patentee has designated, for more clearly explaining his process, A and B.

The composition A, is a mixture of steel, or wrought-iron, in a comminuted state, such as filings, or fine cuttings, with melted rosin, in the proportion of two pounds of filings to five pounds of rosin; it is made into balls of five pounds each, and thrown upon the melted iron, in the ratio of one ball to five hundred weight of metal. If preferred, instead of the rosin, other resinous substances, and the varieties of turpentine, asphaltum, tar, and pitch, may be substituted; and a few pounds of charcoal may be added to the composition. The composition B, is a mixture of common salt, rosin, and charcoal, or other carbonaceous matter, which is made into balls, and thrown upon the fused iron, after it has been acted upon by the balls A, in the proportion of one pound of the composition B, to each hundred weight of metal. Certain other fluxes, such as borax, nitre, or fixed alkalis, may be substituted for the salt.

The second part of this invention consists in subjecting the iron, while in a fluid state, and while in the act of solidifying, to a current of electricity, which is caused to traverse the whole mass.

In casting a bar, or similar mass, the electric current is caused to traverse from end to end, by conductors so arranged, that when the metal runs into the mould it may complete the electric circuit, or by means of a wire, or wires, passed from one end of the mould to the other. If the castings are horizontal, a piece of wrought-iron, or other conducting material, is placed at each end of the mould, which is made of sand, or other non-conducting substance: these conductors are then connected by wires with a galvanic apparatus, or voltaic pile, or electro-magnetic, or other battery, so that, when the melted iron is run into the mould, it will complete the electric circuit; and the patentee prefers to continue the electric current for some time after the iron has solidified. When the castings are vertical, a similar arrangement is made for the passage of the electric current through the metal, by placing a conductor at the top and bottom of the mould in such a manner that the electric circuit will be completed the moment the mould is filled with the liquid iron.

To apply electricity to iron in a smelting furnace, or cupola, a wrought-iron rod is introduced through, or at the side of, the tap-hole, until it comes in contact with the melting metal, and another wrought iron rod is introduced at the upper and posterior part of the hearth, or through one of the tuyere holes, until it reaches the metal; the outer ends of these rods being then connected with a battery, the electric current will be caused to pass through the iron; care being taken not to continue it so long as to entirely decarburate the iron, and bring it to a malleable state. When the electricity is to be applied to the iron in a puddling, or balling, furnace, two iron rods are also used; one of which is inserted into the fused metal, and the other end is connected with a battery; the other rod is attached to an insulating handle of porcelain, pottery, or other non-conducting substance, and a wire from the battery is connected to it, close to the handle. By means of the handle, the extremity of the rod is caused to traverse the iron in its melted state, or during its transition to the solid state, and the electric current will, therefore, pass through the metal in every possible direction.

Claim.—"What I claim as my invention is the improvement in the manufacture of iron, steel, copper, and other metals, by the use and application of electricity as herein described."

12. For an improvement in the mode of *Dressing Mill Stones;* John Black, Helena, Phillips county, Arkansas, August 10.

Claim.—"What I claim is the dressing of the outer edge of the bed stone flat and smooth to an extent and in the manner set forth, and the dressing of that part of the runner that corresponds thereto with lands, usually eight in number, and having their direction the reverse of those on the other part of the face, as described, and for the purpose set forth."

That portion of the bed stone dressed smooth is about one-third of the diameter of the face extending from the periphery inwards, and is reduced about a quarter of an inch below the face of the lands on the other portions of the face. There is a radial groove passing through the smooth part of the face, into which the flour is conducted by the eight lands on the corresponding part of the runner. The patentee says,—"By this mode of dressing the stones their friction is much diminished, and they may be made to run with greater velocity than when the lands on both stones extend to the circumference, whilst the quantity of grain which is ground need not be diminished."

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13. For an improvement in *Railroad Car Wheels;* Ebenezer A. Lester, Boston, Massachusetts, August 10.

The object of this improvement is to make a wheel cast in a single piece with a chilled rim, and without the necessity of a divided hub, as when cast with spokes. This has heretofore been attempted by uniting the hub and chilled rim, or tread, with a dished disk, or two such disks; and the present improvement is for giving to the disk a double wave, or a convexity and concavity on each face.

Claim.—"What I claim as my invention, is the casting of such a wheel with a single continuous plate, or disk, uniting the chilled rim to an undivided hub; said plate being so formed as that a plane bisecting the wheel in its axis shall present a waved line, or one having a convexity on each face of the wheel, in the manner described, and for the purpose set forth."

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14. For improvements in the *Shingle Machine;* Israel G. Johnson, Augusta, Kennebec county, Maine, August 12.

We are under the necessity of omitting the claims of this patent on account of their entire dependence on the drawings, to which reference is made, and as the two improvements claimed are only modifications of machines for sawing shingles which are well known, and in general use, and they could not be understood without drawings of the whole machine, we do not deem it sufficiently important to give the drawings. The first improvement is for an arrangement of gauges for limiting and regulating the length of movements of the carriage; and the second is for so connecting the racks that set the bolt of wood for cutting the shingles with the butt from alternate sides, with the dogs that hold the bolt in such manner that the same thickness of butt can be given for all lengths of shingles, the sliding dogs being connected with the racks by means of a pin on the dogs which slides in a slot at the end of the racks.

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15. For an improvement in the process of *Silvering Looking-Glasses;* Thomas Drayton, Brighton, England, August 12, to run fourteen years from the 25th of November, 1843, the date of the English patent.

[See Specification of English Patent, vol. viii, 3d series, Journal of the Franklin Institute, page 193.]

Claim.—"Having thus described the nature of the invention, and the means pursued in performing the same, I do not confine myself to the precise details herein explained, provided the peculiar character of the invention be retained; but claim to deposite silver on glass from an oxide of that metal in solution by the new process substantially as herein described, wherein I make use of suitable deoxidizing matters in such manner as to cause the silver to adhere to glass without any previous preparation of metallic coating."

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16. For an improvement in *Water-Wheels;* David Putney, Red Bank, Armstrong county, Pennsylvania, August 12.

The wheel is on a vertical shaft, and consists of spiral buckets attached to, or projecting from, a conical hub. This wheel is placed within a "revolving scroll" which communicates directly with the floom to conduct the water to the wheel. The revolving scroll contains two channels which gradually approach the wheel until at their extremity they nearly touch the outer edges of the buckets, so as to enable the water from the floom to strike several buckets at once. The floom is double, entering from opposite sides, one division of the "scroll" communicating with each of them, and the scroll is made to revolve for the purpose of regulating the quantity of water to be admitted to the wheel. The water is discharged at the bottom of the wheel after acting by gravity on the spiral buckets.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the combination of the revolving scroll and trunk, (flooms) and also in combination therewith the wheel arranged and constructed as described."

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17. For an improvement in the *Tongueing and Grooving apparatus of Planing Machines;* Charles W. Brown, Boston, Massachusetts, August 14.

In the planing machines in general use the rotating cutters for tongueing and grooving boards, are so arranged as to be adaptable to boards of various widths, but this setting must be changed for every width; but the improvement is as stated by the patentee, "for the tongueing and grooving of boards of various widths, and superseding the necessity of an adjustment of one of the cutting tools for each board that is to be operated upon; it is peculiarly adapted to the tongueing and grooving of boards of a tapering, or irregular, shape, and this constitutes the great merit of the invention, as the only requisite preparation of the board, before its introduction to the machine, is the making of one edge straight."

Claim.—"What I claim as my invention, is making either the tongueing, or grooving, tool self-adjusting, by arranging the box, or bearing, of the shaft of either of the said tools, so as to slide laterally on a rail, and connecting said box, or bearing, to a sliding guide bar, which bar is governed, or regulated, in its movements by the edge of the board, and kept up against said edge by means of a weight operating upon it, (so as to press it laterally,) through the medium of a rack and pinion, as set forth, the mechanical arrangement and operation being substantially as specified."

There is another claim to a subordinate arrangement of parts which we are under the necessity of omitting, as it refers to, and is wholly dependent upon, the drawing.

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18. For an improvement in the *Smut Machine for Cleaning Grain;* John Pagin, Michigan City, Indiana, August 14.

The patentee says,—"The nature of my invention consists in combining and arranging the fans and beaters of a smut machine, the concave of which is pierced with holes, so that there shall be an equalized current of air upward between the concave and beaters, and an outward current through the cylinder, or runner, and concave."

The runner is vertical, and has a fan at the lower end with two sets of vanes, the first at an angle of about 45 degrees with the shaft, and extending out to about half the diameter of the runner, and the second extending from the outer extremity of the first set, and in lines tangential, or nearly so, to the diameter of the first, and a little curved, —the first set produce the upward, and the second the outward current. The runner has vertical apertures in its periphery parallel with, and between each set of beaters.

Claim.—"I wish it to be understood that I do not claim as my invention the taking air in at the centre below, and blowing it out through the cylinder and concave, as that has before been done, nor do I claim making an upward blast for the same reason; but what I do claim as my invention is the combination of fans substantially as set forth, so as to cause an upward and an outward blast in the manner described."

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19. For an improvement in the *Curry Comb;* Thomas Wilkinson, Cambridge, Washington county, New York, August 16.

The patentee says,—"The nature of my invention consists in the addition of a serrated semi-circular plate to the corner formed by the intersection of the top, and the right hand margin; and also a blade three-fourths of an inch in width on the back, extending from the aforesaid corner, on a line with the top, to its intersection with the left hand margin, designed as a scraper to remove any uncleanness; both to be made of the same metal of which the body is composed."

Claim.—"What I claim is combining with the common curry comb the serrated semi-circular plate, and the scraper, in the manner described."

20. For an improvement in *Fire Engines;* Gardner Barton, Jr., Waterford, Saratoga county, New York, August 16.

This engine has two single acting cylinder pumps as usual, but instead of being permanent they are each connected at their lower end with a branch of the main pipe, by a cylindrical joint at right angles with the axis of the cylinder, the joint consisting of an arbor attached to the cylinder, and fitting in a corresponding cavity in the pipe, the two being provided with openings, or cavities, constituting the water-ways which are opened and closed by the vibrations of the cylinder. The upper ends of the piston rods are provided with a pin that slides in a groove made in a guide rod attached to, and vibrating with, the cylinders—the piston rods being also connected with the brake of the engine, by slides that can be moved along the arms of the brake, and secured at any point desired to regulate the capacity of the engine, for the farther these slides are removed from the axis of the brake, the greater will be the play of the piston, requiring, of course, an equivalent increase of power for working the engine.

Claim.—"What I claim is the combination and arrangement of the cylinders with the guides attached, and their agreement with the slides, by means of which the capacity of the engine may be enlarged, or diminished, at pleasure. I do not claim the invention of vibrating cylinders, but I do claim the invention of the application of the vibrating cylinders to the purposes of pumps for fire engines, in the manner herein before described. I also claim the opening in the upper ends of the guides on which the connecting pins act; and I claim the opening through the arbor, and the corresponding openings, (in the pipes) serving for water passages."

21. For an improved mode of *Keeping Sweet Potatoes;* Aaron H. Vestal, Cambridge City, Wayne county, Indiana, August 16.

The patentee says,—"The nature of my invention and discovery consists in so regulating the temperature of the air in the room in which the potatoes are to be kept, as to prevent them from becoming chilled, or frozen, or from becoming too warm either by reason of the artificial heat produced in the room, or from becoming heated by too large quantities being packed together, so as not to admit a free access of air, either of which would prove destructive to the potatoe."

The potatoes are to be put into a box three or more feet square, and of any height desired, made of wood, three sides of which are boarded up in a reversed manner from that usually employed in boarding the sides of a framed house, the boards being kept apart by wedges; this admits a free circulation of air without permitting the escape of the sand in which the potatoes are packed. The front of this box is left open, the two sides being connected at top and bottom, for the reception of strips of boards to be slipped in, as the potatoes are packed in, and the bottom, which is to be elevated a few inches from the floor, is composed of strips at right angles, one range above the other to form air passages. In packing the potatoes in sand, tubes, for the admission of air, are introduced here and there along the height of the pile.

Claim.—"What I claim is the box for keeping sweet potatoes, said box being constructed with ventilated sides and air tubes, the arrangement and construction of which is substantially as described."

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22. For an improvement in the *Cultivator;* William Dyzert, Gettysburg, Adams county, Pennsylvania, August 16.

This cultivator is for the working of corn, and consists in connecting two cultivators together, by means of two curved, or arch, pieces, to leave a space between the two of sufficient height to pass over the corn, and thus work it on both sides at the same time. The tongue to which the team is to be harnessed is attached to the upper part of the curved braces, or arch pieces.

Claim.—"What I claim is the curved iron braces which connect the two sides together, in combination with said sides and the tongue, constructed for the purpose, and arranged in the manner described."

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23. For a machine for *Turning Spools, or Bobbins;* Jonathan H. Cary, North New Salem, Franklin county, Massachusetts, August 21.

The piece of timber from which the spools are to be formed, is put into a hollow mandrel of considerable length, by which it is rotated. A sliding borer is applied in front for boring the hole, and at the same time a set of tools, attached to a sliding stock, are brought up, which turn the outer surface, and reduce the body, or that part which receives the thread, or yarn, and at the same time a circular saw, which is hung to the upper end of a vibrating beam, cuts it off from the stick. The movements of these various instruments are so regulated as not to interfere with one another.

Claim.—"I shall claim the machinery for sustaining the stick, and giving to it a cylindrical form, in combination with that for reducing the cylindric of the stick, so as to form the body (of the spool, or bobbin,) or part on which the thread is wound, with that for cutting off sections, or parts, of the stick of the length to form spools, or bobbins, and with that for drilling, or boring, the hole through the axis of the stick, or spools,—the whole arranged and operating substantially as set forth."

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24. For improvements in *Flouring Mills;* John Ansell, and James Gallery, Brooklyn, Kings county, New York, August 21.

The patentees make the following claim, viz:—

Claim.—"We claim as new, and of our own invention and discovery, and desire to secure by letters patent, the mode described of dressing the stones with the curved furrows, having the circle cut in the reverse direction from those hitherto used, such furrows being widest and deepest near the eye, and the furrows of the runner being hollowing, or fluted, from the front, or feather edge, to the back, while those of the bed stone are cut in an angular form from the front to the back, in combination with the mode described of forming the eye of the runner conical, or bell-mouthed, below the upper part of the bail, when such mode of dressing and combination are employed with stones made and driven as described, and applied to any description of stones in which they may be equally available. Secondly, we claim, in like manner, the mode described of applying the action of a governor, similar to that used with the steam engine, to operate through the lever *l*, rod *m*, and cross lever *n*, to act on the runner, and feed when any variation occurs in the speed through any action of the lever *o*, slide 5, and rod 6, to raise, or lower, the shoe *p*, on its joint substantially as described."

To explain the references in the claim, we will remark that the slide of the governor is embraced by a fork on the end of the lever *l*, which has its fulcrum at the other end—at about one-third of its length from the fork it is jointed by a link to one end of a lever *o*, the other end of which is jointed to a rod 5, working in a slide, to which the shoe is jointed by a link 6.

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25. For an improvement in the *Key for fastening the Rails of railroads to their Chairs;* Benjamin Butterfield, Kensington, Philadelphia county, Pennsylvania, August 21.

This key is a dove-tail wedge with the thin end turned over to form a spring catch, which will close in driving the key in to fasten the rail to the chair, and after the spring has been driven beyond the side of the chair it flies out and forms a catch, to prevent the key from working out by the constant jar.

Claim.—"What I claim as my invention is the dove-tailed wedge, in combination with the spring hold-fast at one end of the wedge, to prevent its receding, or working out of the chair, and thus permanently securing the rails at their junction in the chair."

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26. For an improvement in the *Washing Machine;* David Kauffman, Mohecanville, Wayne county, Ohio, August 21.

This machine consists of a double series of rollers, arranged in two concentric circles, with sufficient space between the two series for the passage of the clothes to be washed, which are attached to, and carried around by a rod attached at each end to a wheel, the two wheels being rotated by appropriate cog-wheels. The gudgeons of the outer series of rollers slide in grooves so inclined as to cause them, by their weight, to press the clothes between the two series.

Claim.—"What I claim is arranging the double series of rollers in a circle in the manner described, and combining therewith the rod, or other suitable carrier, for taking the clothes round between the rollers in the manner and for the purpose specified."

27. For an improvement in the *Churn;* Thomas Ling, Portland, Cumberland county, Maine, August 21.

Within the cylindrical barrel of the churn there is another smaller cylinder of less height, and within the latter is a shaft which passes through the top to receive a crank handle, and from which a broad threaded screw, or other similar device, projects for the purpose of working the cream; holes are made near the bottom of the inner cylinder, and the upper end has a flanch inclining outwards.

The rotation of the screw produces a current of the cream through the holes at the bottom up the small cylinder, and down between the small and large cylinders—the butter, when forming, floating on the surface of the cream above the small cylinder.

Claim.—"What I claim is the combination of the large cylinder, the small cylinder with its perforations and flanch, and an apparatus for withdrawing the cream from the large cylinder, raising it in the small cylinder, and discharging it again into the larger one, not, however, confining myself to the screw for that purpose, but substituting any other contrivance by which the same result can be attained."

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28. For improvements in the machine for *Sawing Laths and Clapboards;* E. C. Gilman, Canaan, Grafton county, New Hampshire, August 23.

This patent is granted for two improvements on the machines generally used for this purpose, which consist of a circular saw and reciprocating carriage that carries the block of wood. The first improvement claimed is for an arrangement of parts for shifting the clutch from the cog-wheels that run the carriage up, to the band wheels by which it is run back. This consists of a sliding bar, operated by a pin, or projection, at each end of the carriage; the outer end of the bar is provided with two projections that embrace the end of a lever, and two springs attached to it, there being sufficient play between these projections for the end of the lever, which is to be cast from one side to the other alternately by the springs. A projection from the side of the lever fits alternately into two notches in the frame, and the bar, towards each projection, has an inclined piece which forces the lever out of these notches. The lower end of this lever is connected with the clutch, and the whole operates in the following manner:—Lowers the end of the forward motion of the carriage, the bar is drawn forward by it, and one of the projections draws up the spring which bears against it—at the same time the inclined piece disengages the lever from the notch, which leaves it free to be forced forward by the spring that has been drawn up—this shifts the clutch from the cog-wheel to the backing belt wheel by which the carriage is run back, and towards the end of this motion the same thing takes place to disengage the lever, and shift the clutch.

And the second improvement is for raising and dropping the back of the carriage to give the required bevel to the clapboard; the back rail on which the carriage runs, rests on three levers, the lower ends of which are connected together by a rod, and as this is drawn to one side, or the other, the rail with the carriage on it is lifted, or let down. The shifting of the rod is effected by what is called a "set, or pointer," in the specification, so jointed to the under side of the carriage as to be moved by a wedge, which is shifted from one side to the other by the end of two levers that operate the rod by which the rail and carriage are lifted, &c.; as the carriage moves back, the set, or pointer, comes against the side of a wedge, which conducts it against one of the shifting levers—this lifts the rail and carriage at the end of the back motion, and at the same time shifts the wedge; and on the return of the carriage, the set, or pointer, passes over the top of the wedge, and when the carriage moves back again, the set, or pointer, is guided by the wedge to the other side, where the other lever is located, and by means of which the rail and carriage are let down. The butt end of the wedge is so formed that the motion of the levers shifts it.

Claim.—"I claim as my invention the combination of mechanism which acts in such manner as to connect the dog (clutch) alternately with the gear and the pulley, as described; and also claim as my invention, the combination of mechanism for elevating the side of the carriage, next the attendant, in such manner as to secure the proper degree of bevel for the stuff to be sawed, the same being effected by means of the three levers suspended by hinges, and the two upright antagonist levers (shifting levers,) and the connexion between them, and also the combination between these and the horizontal lever, (connecting rod) as described."

29. For improvements in the *Printing Press;* Alonzo Gilman, Troy, Renssalaer county, New York, August 23.

This is for improvements in the vertical press used for printing cards; the first is for hanging the inking rollers to a working frame in such manner as to adapt them to the curvature of the cylinder that gives the ink, and to the face of the types. The rollers are hung in a working frame, the lower end of which is jointed to arms projecting from a rocking shaft operated by the same cam that works the toggle of the press. And the second is for adding to this kind of press a frisket for adapting it to the printing of sheets of paper instead of cards; this frisket is jointed to a sliding frame worked by a lever turning on the rocking shaft that operates the inking rollers, and it is closed by rollers that bear against its edges as it descends between the bed and platen of the press.

Claim.—"What I claim is the hanging the inking rollers in the manner above described, in the working frame provided for them, by means of which they are made conformable to the curve of the cylinder, and the face of the types, and so as to be adjustable thereto at discretion. I also claim the combination of a frisket with the said machine in the manner and for the purposes above described."

30. For a machine for forming the *Knuckles of Butt Hinges* that

are manufactured of rolled iron, or other malleable metal; Cyrus Kenney, Troy, New York, August 23.

In this machine the knuckles of hinges are bent by two operations, the first of which gives them a semi-cylindrical form by means of two permanent dies placed at a distance apart from each other equal to the diameter of the semi-cylinder to be formed. The back one of these two dies has a flanch, or shoulder, against which the piece to be bent is pushed by the attendant, to gauge the bend. The metal is forced in between these dies, and bent by means of a third die attached to the end of a lever by which it is operated. The piece thus bent is then put into the other part of the machine, to undergo the second operation. It is laid on a bed die in the form of a rebate, with the back part of the hinge plate against a gauge plate, or die, and the turned edge resting on the lower part of the die; it is then acted upon by two other dies attached to, and moving with, a lever turning on a pin below, and actuated by a crank and connecting rod behind. By this arrangement one of the dies bears lightly on that part of the hinge plate which is uppermost, and the other is forced up against the bent part, and curls up the metal into a cylindrical form.

In the claim, the two permanent dies of the first operation are designated by the letters *b* and *c*, and the movable die by the letter I; and in the second operation the bed die is designated by the letter *e*, the gauge by the letter *f*, the movable die that bears on the top by the letter *h*, and the other by the letter *i*.

Claim.—"Having thus fully described the nature of my machine for bending the projecting pieces on the flaps of butt hinges, so as to form them into knuckles, and having also shown the manner in which the same operates, what I claim as new therein, and desire to secure by letters patent, is the so combining and arranging its parts in the manner set forth, as that the pieces to be bent shall first have one-half of the intended curvature given to them by dies, formed and actuated in the manner of those designated by I *b c*, and shall subsequently have the bending completed by means of a die, check piece, bed and gauge piece, such as are shown at *i h a* and *f;* the respective parts of the whole machine being arranged and actuated substantially as made known."

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31. For an improvement in *Scoop Excavators*, for removing mud from the bottoms of rivers, canals, &c.; Joseph Smith, Mansfield, Richland county, Ohio, August 24.

The sides, or ends, of this scoop are curved in the form of a sickle, and made sharp for the purpose of cutting roots, &c., and are provided each with a gudgeon which works in a frame, by which the whole is dragged. The bottom of the scoop is perforated to permit the water to pass through, and from the back two curved runners project, on which the scoop runs after it has been filled and turned sufficiently to hold the mud, &c. On the frame there are two lever catches that fit in holes in the sides of the scoop, for the purpose of retaining it in any desired position relatively to the frame; these two lever catches are linked with two other levers, so arranged, with connecting rods along the handle, as to enable the attendants, by means of these and cords attached to the runners, to govern the position of the scoop.

Claim.—"What I claim as my invention, is the combination of the perforated scoop and runners with the levers, (the two sets) rods and apparatus for discharging the scoop, constructed and operated in the manner above set forth."

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32. For an improvement in the machine for *Cutting Match Splints;* Hervey Law, Wilmington, New Hanover county, North Carolina, August 28.

Match splints have heretofore and are now, in some instances, made by means of a steel tube sharpened at one end, and attached to a hand plane, the tube cutting a cylindrical rod the size of the hole. One of the improvements under this patent is for combining with this tube, or a series of them, a lip which tends more effectually to sever the rod from the block, and leaves the surface prepared for another cut. And the other improvement is for an arrangement of parts constituting a machine for making splints by means of such tubes attached to a slide, the block being fed up at the end of each operation, and held firmly by a wedge.

Claim.—What I claim as my invention, is combining with the tube cutters the flanch, or wing, for the purpose and in the manner described, whether the tubes are made in sets, or in single tubes; and also the combination of the movable lip with the follower, the wedge and tube cutters, in the manner and for the purpose set forth. And I do hereby declare that I do not intend, by the description given, to confine myself, in the second claim, to the precise shape, or form, or manner, of arranging and connecting the auxiliary parts of the feeding apparatus, or to the peculiar form, or arrangement, of the tube cutters, but to vary them as I may find expedient, whilst the general construction and operation of the feeding apparatus, is substantially the same with that set forth, and whilst it is made to retain those features which distinguish it from all other machines which have heretofore been constructed for the same purpose."

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33. For an improvement in the *Brick Press;* Jeffery Smedley, Columbia, Lancaster county, Pennsylvania, August 28.

This is for an improvement in the press for compressing, or repressing, bricks. The follower, or platen, of this press acts upwards—the lid of the mould when closed being the bed. To the slide of the follower there is an arm jointed, like one arm of a toggle joint, the lower end of which is caught by a cam on a cylinder, or shaft, below, so hollowed out as to form a seat for the end of the arm, and thus together act as a toggle joint in giving the pressure; on the return motion of the shaft (which is a rocking one,) another cam strikes against a curved arm (called in the claim a segmental cam) projecting from the arm of the follower just described, and forces the follower up higher to discharge the pressed brick, the lid having been lifted up in the commencement of the back motion of the rocking shaft by a lever connected with a slide, actuated by a third cam on the rocking shaft.

Claim.—"What I claim as my invention, is the arrangement of the cams (first and second) upon the rocking shaft, in combination with the follower and the segmental cam, and in combination with the above I claim cam (third) and sliding rod for operating the lid, the whole arrangement and operation being substantially as described."

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34. For a machine for *Cutting and Gathering Corn, Sugar-Cane, &c.;* Jacob Peck, Oakland county, Tennessee, August 28.

The knife for cutting the stocks of corn, or sugar-cane, or other similar article, is attached to the side frame of a car; it projects from the side of the frame in a curved line, so that the frame shall support the cane whilst under the action of the knife. There is a vertical shaft with arms projecting therefrom on the frame and near the knife, and rotated by means of a bevel cog-wheel taking into cogs on the front driving wheels. The stocks are caught by these arms, and deposited on the platform of the car, there being appropriate guides for this purpose.

Claim.—"What I claim is the knife in combination with the revolving cross arms driven by the bevel cog-wheels, arranged and constructed as described; and also the arrangement of the knife and revolving cross arms, in combination with the car and guiding rod, as described."

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35. For a *Governor for regulating the movements of Mill Wheels, Steam Engines,* and other machinery; Henry Burt, Boston, Massachusetts, August 31.

Instead of the balls and arms thrown out by centrifugal force, or jointed wings opened by the resistance of the air, as the velocity of the machinery is increased, the present patentee employs a vertical shaft with spiral wings, (made in the manner of the screw propeller,) and so placed in a vessel filled with water, or other fluid, that the resistance of the fluid acting on the spiral vanes, or wings, by the increased motion of the machinery, causes the shaft and vanes to rise, and when the velocity is diminished, and the resistance thereby reduced below the gravitating force of the weight of the shaft and wings, or vanes, it descends, and by its connexion with the throttle valve of an engine, gate of a mill, &c., the moving force of the machinery is either increased, or diminished.

Claim.—"Having thus explained my invention, I shall claim the employment, as a governor, of a screw, or other analogous contrivance, as described, to revolve in water, or other fluid, and act therein, and in all respects substantially as set forth."

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36. For a machine for *Cutting Sausage Meat;* Edwin Clark, Hartford, Connecticut, August 31.

This machine resembles that kind of straw cutters in which the cutters are attached to the face of a wheel, or the arms of a fly-wheel. The forward end of the trough is provided with two series of knives, one horizontal, and the other vertical, forming apertures, or meshes, through which the meat is forced by a piston, or follower, into long pieces, which are again cut by the rotating knives as they pass out.

Claim.—"What I claim is the combination of the revolving and parallel knives, and in combination therewith the piston for forcing the meat through the parallel knives."

37. For an improvement in the method of making *Patterns for Casting Hollow Ware*, and other articles of metal, in which the inner and outer patterns are required to be of a corresponding figure; Ezra Ripley, Troy, Rensselaer county, New York, August 31.

Instead of making, or carving, an inner and an outer pattern of the form required to cast any desired article between, one of the patterns only is made, say, for instance, the inner one, and from this a casting is made which is to answer the purpose of the inner pattern. After this the first made pattern is coated over with paint, and then a coating of sand, and then again paint and sand, and so on until the desired thickness of the casting is attained, and from this a casting is to be made to answer the purpose of the outer pattern, or mould. This mode of obtaining the outer from the inner, or the inner from the outer, pattern, enables the operator to obtain the corresponding figure without any difficulty. Any kind of mastic can be substituted for the paint and sand.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode, or manner, in which I obtain iron, or other metallic, castings, or second patterns, of nearly uniform thickness, by means of spreading any suitable material, or composition, on the face of the aforesaid plaster cast in thickness equal to the thickness of the iron, or other metallic, castings, or second patterns, afterwards to be obtained, and the principle involved in such mode of proceeding."

38. For a *Hydro-Pneumatic Apparatus* for raising beer from casks, &c.; Richard Sealey, New York City, August 31.

From a reservoir of water placed at any desirable height, a pipe provided with regulating cocks, descends and opens into another vessel, and near the bottom thereof, and from near the top of this another pipe descends into and near the bottom of an air vessel. In the claim the first of these vessels is indicated by the letter A, the second by the letter B, and the air vessel by the letter C. The air vessel C, is provided with a draw-off cock placed a little above the lower end of the last mentioned pipe, so that the water into which the end of the pipe dips, may be drawn off when too great a quantity has accumulated without suffering it to descend below the end of the pipe. The upper part of the air chamber is separated from the lower by a double acting valve, which closes upwards and downwards, and below this is a float, which, when forced up, closes the valve. From the upper of these chambers a pipe extends to one or more casks, which are also provided with pipes which extend to the apartment, or place, where the liquor is to be discharged. The vessels A and B are provided with pipes and cocks connecting them with a pump, &c., by which they can be supplied with water, or air, as required.

When water is permitted to descend from the reservoir A, into the vessel B, the air is forced up, and passes down the pipe into the air vessel, and from thence into the casks; but should the water in vessel B, rise high enough to pass down into the vessel C, and there accumulate, it cannot enter the casks, for the float will be forced up and close the valve.

Claim.—"I am aware that the conjoint action of water and air has been used for the purpose of raising liquids, but I am not aware that any similar arrangement has been applied to the two-fold purpose of raising the fermented, or other, liquors, from the cask to the place where it may be drawn for use, and at the same time avail of the pressure of the air on the surface of the liquor in the casks to preserve the liquor itself; and I am aware that I cannot claim to be the inventor of any of the parts employed taken separately, as each is already well known; therefore, I only claim as new the application of the arrangement and combination of the vessels A B and C, with the pipes, cocks, and valves, as described, when such application, arrangement, and combination are employed for the two-fold purpose of raising fermented, or other liquor, from the casks, to the place where it may be drawn for use, and of preserving the liquor itself, by maintaining a considerable atmospheric pressure on the surface of the liquor within the cask, substantially as described."

Patents Re-issued for Amendments in the month of August, 1844.

1. For improvements in the *Locks of Pistols*, and other fire arms; Ethan Allen, Norwich, Worcester county, Massachusetts, August 3.

This patent was originally granted on the 11th of November, 1837, and reissued on the 15th of January, 1844, and, therefore, the reader is referred to the notices heretofore given in this Journal, for a description of the general characteristics of the improvements, the present reissue having been obtained for an amendment of the claim simply.

Claim.—"I claim a mechanism for elevating the cock from the nipple by a simple pull of the trigger in combination with a mechanism which so separates certain parts during, and by, said pull of the trigger, as to permit the cock to be thrown down upon the nipple, by the reaction of the main spring; all as set forth; and a mechanism that, by the said pull of the trigger, has a power generated within it, which, on the release of the retractile force, or finger, from the trigger, shall immediately reannex the disconnected parts, or restore them to their requisite positions for the accomplishment of another discharge by another pull of the trigger, as explained; the whole being arranged and operating substantially as hereinbefore specified."

2. For an improvement in the *Press for Packing Cotton*, and for other purposes; S. W. Bullock, Williamsburgh, New York, August 11.

This patent was originally granted on the 23d of March, 1842, and as it is one of those not yet noticed in this Journal, we will here give the claims under the original as well as the reissued patent.

The follower is operated by means of a segment cog-wheel and pinion, the centre of the former being connected with the shaft of the latter by bridles, or stirrups. The cog-wheel is also connected with the under part of the follower by a gudgeon, so that the semi-diameter of the segment wheel from the centre to its connexion with the follower constitutes one arm, and the bridles connecting the centre of the segment wheel with the shaft of the pinion, the other arm of a toggle joint,—the pinion and its shaft being in a vertical line below the connexion of the segment wheel and follower.

Claim.—"What I claim as new is the manner in which I have combined the follower and the segment wheel with the pinion and its shaft, the axis of the segment wheel, and the shaft being connected by bridles in the manner set forth, and the follower being sustained and operated on by the segment wheel through the intermedium of a gudgeon, or other analogous device, on the under side of said follower, the respective parts being combined and operating substantially in the manner set forth."

Claim under the new patent.—"What I claim is the manner in which I have constructed the press by the combination of the segment wheel with the pinion and its shaft, the axis, or fulcrum, of the segment being at the jointed part of the arms, or other analogous devices, that will allow of the axis, or fulcrum, moving from an acute angle to a straight line with the point on which the arms rest, and the line on which the gudgeon moves, and vice versa; in other words, I claim the invention, or discovery, of moving the axis, or fulcrum, of a wheel, or lever, in the simple act of operation of said lever, or wheel, the axis, or fulcrum, of which is at the movable joint, (the connexion of the bridles and axis of the segment wheel,) so as to produce a direct force against the object to be moved—with all the advantages of the progressive power of the toggle joint operated by an extended lever—the whole being combined and operating substantially in the manner set forth."

Patents for Designs which issued in the month of August, 1844, *under the third section of the Act of August* 29, 1842.

For a *Medallion Portrait Bust of Theodore Frelinghuysen, in Mezzo-relief;* Salathiel Ellis, assigned to John G. Wellstood, New York City, August 12.

List of American Patents which issued in the month of November, 1841, with Remarks and Exemplifications. By CHARLES M. KELLER, Examiner of Patents.

1. For improvements in the *Saw Mill* for resawing boards and other lumber; Pearson Crosby, Freedonia, Chautauque county, New York, November 3.

The object of these improvements, as expressed in the title, is for resawing, or slitting, boards of any thickness, and of any irregularity, and as the claim refers to, and is wholly dependent on, the drawings, we will be under the necessity of omitting them; they are confined, first, to an arrangement of vertical rollers which sustain and present the board to the saw; one set of these are feed rollers, geared to the machinery, and operated by the ratchet wheel, and the board is held and pressed against them by another set suspended to appropriately arranged levers, which bear them up, and admit of their yielding to any irregularity in the thickness of the board; second, to the arrangement of these rollers in sections and connecting the axles of the different sections by joints to slit the boards diagonally, so that two clap-boards may be cut from one board, the jointed parts of the axles of the feed rollers being connected with slides governed by screws to adjust their position, and the joints of the pressure rollers free to adapt themselves to the position given to the feed rollers; third, to an arrangement and combination of the parts for working the feeding apparatus. And finally, to an improvement in the mode of straining the saw, by means of three stirrups at each end instead of one, the main stirrup being attached in the usual manner to the gate, and the other two jointed to the first—one being attached to the front, and the other to the back edge of the saw.

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2. For *Safety Boxes for Railroad Axles;* Peter and William C. Allison, Philadelphia, Pennsylvania, November 3.

This is for the purpose of giving additional strength to the parts of the axle inside of the wheels where they are most liable to break, and consists of divided boxes made in two parts, with flanches at the end and sides, the former to secure them by screw bolts, &c., to the wheels, and the latter to bolt the two halves together, embracing the axle which is grooved in the direction of the circumference to receive fillets on the inside of the boxes.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction and arrangement of the safety boxes on the axles of the car wheels, having tongues (fillets) inside said boxes, fitting into corresponding grooves in the peripheries of the axles in the manner and for the purpose set forth, and rods, or hooks, with screw nuts for securing the safety boxes to the car wheels, as above described, or whether constructed in any other manner substantially the same, and for a similar purpose."

3. For an improvement in the *Steam Engine;* Joseph Frost, Brooklyn, New York, November 3.

The patentee says,—"I denominate my improved engine the reciprocating expansion engine, and I so denominate it because I use the same steam expansively in two, three, or more, cylinders in succession, each of larger capacity than that which precedes it. The first, or smallest, cylinder is to receive its supply of steam directly from the boiler, or generator, which is constructed and heated in the ordinary way. Along side of this boiler I place steam receivers, or reservoirs, which I usually make cylindrical, and of the same length with the boiler; these I make capacious, say of half the diameter of the boiler, more or less; they are intended to receive the steam after it has acted in one cylinder on its way to that in which it is next to operate. These steam receivers I keep heated by causing the gaseous products of combustion to pass through flues below them, on their way to the chimney, instead of allowing them to pass directly thereto; the heat, therefore, which otherwise would be wasted, I employ to heat these receivers, and thus preserve and increase the elasticity of the steam during its passage from one cylinder to another. As the heat thus communicated to these steam receivers, will, in general, be sufficient not only to preserve the elasticity of the steam, but also, as above indicated, to augment it, I cause them to receive a small supply of water, which may be evaporated by this excess of heat, and thus operate in increasing the power of the engine without increasing the consumption of fuel."

Claim.—"What I claim as my invention, is the use, in combination of two, three, or more, steam cylinders in which the same steam is to be used expansively, its supply being cut off at any preferred part of the stroke, and the successive cylinders being of increased capacity, as set forth, and in combination with said cylinders, and as making a part of my particular arrangement I claim the employment of the steam receivers, intermediate between the respective cylinders; said receivers being heated by the heated air from the furnace in its passage to the chimney; the whole being combined, arranged, and operating substantially as described. I do not claim any of the component parts of this apparatus taken individually, nor do I claim the right of using the same steam in two or more cylinders successively, that having been done by James Watt, and by others; nor do I claim the exclusive right of using steam in an engine with double cylinders of unequal dimensions, where the steam is used expansively in the larger cylinder, while the steam reacts with a great and variable force against the piston of the smaller cylinder propelled by unexpanded high steam, this having been done and is still done in Woolf's engine."

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4. For an improvement in *Air-Tight Stoves;* Joseph E. Fisk, Salem, Essex county, Massachusetts, November 3.

Claim.—"I shall claim arranging the fire pot in the fire chamber of an air-tight stove, in the manner described, so that the smoke and heated products of combustion, after being conducted through the several chambers and pipes, as specified, and imparting heat to the room, are again brought into direct contact with the burning fuel by passing between said fire pot and chamber to the surface of the fuel in the fire pot, when such parts as are capable of further combustion, are more effectually consumed, and then again circulated as before, the whole arrangement and operation being substantially as set forth."

5. For an improvement in *Shears for Cutting Metals;* William Bulkley, and Otis M. Inman, Berlin, Hartford county, Connecticut, November 3.

This is for an improvement in shears used by workers in tin plate ware, for cutting circular plates of sheet metals. The shears are, as now generally used, composed of two rotating plates, the sharpened edges of which act together in performing the cutting operation, and have their bearings in studs connected with an open elliptical frame, (incorrectly called in the claim a "bow,") by slides and set screws for adjustment to each other, and to the cutting of plates of different diameters. This frame, or bow, turns on the gudgeons, or bearings, of the clamp plates in which the sheets of metal are secured, so that it can turn thereon, and carry the shears around to cut the circle.

Claim.—"We do not claim as our invention the bow, or frame, or its application to the arbor, nor do we claim the attachment of the shears, so as to carry them around the arbor, as these have all been known before; but what we do claim as our invention, is attaching the studs, in which the shears work, to the bow, or frame, which receives the gudgeons, or bearings, of the arbor, and which travels around on it substantially in the manner described."

6. For an improvement in the mode of rendering *Fabrics Water-Proof;* Thomas B. Rogers, New York City, November 3.

The following is the specification, viz.,—My improvement consists in rendering cloth water-proof by saturating it with a material which is insoluble in water, but which admits of the free passage of air through its fibres—a feature in which it differs from fabrics rendered water-proof by means of caoutchouc and similar articles. The following is a description of the process which I employ:—

"In a vat of a suitable size I form a solution of sulphate of soda, or glauber salts, generally in the proportion of three quarters of a pound of the salts to a gallon of water, and in this I immerse the cloth; when it has become fully saturated, I convey it to another vat containing a solution of acetate, or sugar of lead, and permit it to remain there a sufficient time to enable a chemical reaction to take place between the solution of sulphate of soda with which the cloth was saturated before entering the second vat, and the solution of acetate of lead in this vat. The effect of this reaction is to make a soluble acetate of soda, and an insoluble acetate of lead—the former of which is dissolved in the vats, while the latter is precipitated among the fibres of the cloth, and forms the principal means by which I render the cloth water-proof. After taking the cloth out of this last vat I immerse it in another containing a solution of sulphuric acid in the proportion of about sixteen drops to the gallon of water, for the purpose of rendering the lead in the fibres of the cloth a perfect sulphate. The cloth I afterwards pass through a solution of camphor in water, but which is not necessary to my invention, for the purpose of removing the unpleasant odour arising from the use of the acetate of lead. After which it is scoured with warm water and soap to remove the excess of acid, and any of the materials, or ingredients, referred to, that may remain on its surface. I have mentioned sulphate of soda as one of the articles used in this process; this I employ only for the purpose of decomposing the sugar of lead as stated, and as there are several other sulphates which will produce the same effect, I do not intend to limit myself to the use of this, but to employ any of the others should I find it expedient to do so.

"What I claim as my invention, therefore, and desire to secure by letters patent, is the mode of rendering fabrics water-proof by passing them through successive solutions of sulphate of soda, or its equivalent, acetate of lead, and sulphuric acid, as herein set forth."

7. For an improvement in *Bedsteads;* John P. Allen, Manchester, Essex county, Massachusetts, November 3.

On each end of the rails there is a left handed screw cut next to the shoulder which receives a nut, and beyond this a right handed screw of less diameter, which screws into the post, there being sufficient space left between the face of the post and the shoulder on the rail for the nut to be turned up, by means of a small winch, or lever, against the face of the post to render the joint tight. By loosening the nut, the rail, or beam, can be turned at any time to tighten the sacking, after which the nut can be screwed up and the joints made firm.

Claim.—"What I claim is the method described of making the joints of bedsteads firm and tight, and giving sufficient play to the screws on the ends of the rails for tightening the sacking by means of the nuts in combination with the rails and right and left handed screw on the ends of the rails, as described."

8. For improvements in *Saw Mills;* Frederick Goodell and Thomas W. Harvey, New York City, November 3.

The claim refers throughout to, and is wholly dependent on, the drawings, which we are therefore under the necessity of omitting. The first claim is limited to the arrangement of the gearing which operates the crank shaft and the feeding motion of the carriage, (which is continuous,) these two motions being connected by a set of cone pulleys, that the feeding may be changed and regulated during the operation of the mill. The second is to the arrangement for setting the log in which the screws, that move the slides, on which the log rests, on the head and tail blocks, are connected together by a cord passing over a pulley on each screw shaft, (and giving motion to it by a ratchet,) and the ends attached to a longitudinal slide on one of the rails of the carriage, which slide, at each motion of the carriage, is moved by appropriate fixtures attached to the floor of the mill. The third is for the manner of trussing the upper and lower ends of the saw frame, or gate, by means of arch pieces abutting against notches in the ends of the cross, or tie, pieces, with wedges between the two, and the whole embraced by the stirrups; the object of which arrangement is to give the requisite strength to resist the strain of the saw with less weight than heretofore. And the fourth is for "feeding the stuff to the saw by means of a continuous motion, in combination with a reciprocating saw having sufficient rake to clear itself in raising, so as to admit of such continuous motion of the carriage."

9. For a machine for *Cutting Stone;* Thomas J. Cornell, Worcester, Massachusetts, November 3.

In this machine the stone is to be cut by means of cutters projecting radially from a wheel, and sliding in radial grooves therein; the operation, therefore, is very similar to a circular saw, except that the cutters rotate slowly. The cutters are moved out as fast as they wear, by means of pinions on screw shafts parallel with the cutters, there being a nut on each screw that actuates the cutter. The nuts are turned at each revolution of the cutter wheel by taking into a segment so connected with a set of levers that the cutters are only advanced as fast as the cutters wear away.

Claim.—"What I claim as my invention, is the mode of adjusting the tools to one and the same length, from the edge of the wheel, however much, or little, they may wear off in cutting the stone, by means of the operation of the regulators acting upon the pinions to turn the screws, and to move the nuts, as is fully set forth and described in the specification."

10. For an improvement in the *Action of Piano Fortes,* for modifying the tone; Daniel B. Newhall, Boston, Massachusetts, November 3.

Claim.—"What I claim as my invention, is the mode of varying the points at which the force is applied to the hammer, so as to produce at pleasure a piano, or pianissimo, tone by means either of an under hammer rail, and hammer made movable, as described, and operated substantially as set forth; or by making the cheeks movable instead of the hammer rail, and operating them in the same manner, so as to produce a similar effect."

This rail is simply made to slide by connecting it with a pedal, so as to place it entirely under the control of the performer, to increase and decrease the leverage of the hammers.

11. For an improvement in the *Cocoonery for Feeding Silk Worms;* J. B. Tillinghast, Norwalk, Huron county, Ohio, November 10.

The patentee says,—"In the feeding of silk worms the greatest difficulty and labor occur in the last stage of this operation—that is to say, after the fourth moulting—and it is to this stage of the business only that my improvement applies. In the old way of feeding worms upon shelves, or hurdles, at a period when so much food is required as in this last stage, and when it is necessary to be especially careful to keep them well supplied with food, and perfectly clean, in order to insure their remaining in a healthy state, so many difficulties have been encountered as to cause the abandonment of the business by numbers who had engaged in it, and to render it manifest that without some great improvement it could not be carried on in a country where hand labor is attended with the expense incident to our situation in the United States. It must be admitted also, that the more nearly we can allow the worm to operate according to its natural instincts, the more likely we shall be to succeed in deriving profit from its products. Under the guidance of the experience, and of the reasoning above noticed, I have so constructed a part of my cocoonery as to admit of the worms being fed upon whole trees, or upon the large branches of trees, and upon these also they are allowed to spin their cocoons. I feed my worms as formerly upon shelves, until they revive from their fourth moulting, when I remove them to an apartment constructed for the special purpose above indicated."

Claim.—"What I claim is the manner of constructing my frames in the cocoon room by suspending them from the rafters, and so that the shelves from the feeding room can be readily attached to, and removed from, their under side, and that the trees, or large branches, which are to supply the last portion of their food, and constitute a lodgment for the cocoons, may be sustained upon strips of wood for the purpose and in the manner set forth; and I claim the so making and using of the structure, or apparatus, for the purpose and in the manner aforesaid."

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12. For an improvement in the mode of *Bating Hides in the process of Tanning;* Simeon Guildford, borough and county of Lebanon, Pennsylvania, November 10.

This improvement consists in using the sulphate of alumine, common alum, in solution with water, for the purpose of extracting the lime and saponaceous matter with which the hides are saturated; the acid of the alum unites with the lime, and the astringent properties of the alum, adds to the cohesion and strength of the hides as they come out of the lime, and at the same time distends and thickens them, and causes them more readily to imbibe the tannin of the bark, of which something less is required in consequence of the use of the alum bating liquor.

Claim.—"What I claim as my improvement in the art of tanning is the use of alum in the process of tanning with bark, and for the purpose of bating the hides as specified."

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13. For an improvement in the *Stop Motion for Power Looms;* O.

M. Stillman, Stonington, New London county, Connecticut, November 10.

A plate is attached to the breast beam under the cloth, and extending towards the reed, in which there is a slide armed at the end towards the reed with small vertical pins, which are woven into the cloth when the filling does not fail, and by which the slide is held back until the harness changes, at which time it is liberated and forced towards the reed preparatory to another operation. This holding of the slide back by weaving in the pins, holds up a hinged hook, but when the filling fails the slide moves back with the reed, and permits this hook to be caught by another hook on the lay, and the former being in connexion with the shipper, the loom is thrown out of gear, and stopped.

Claim.—"What I claim as my invention is the employment of the teeth attached to the slide, for the purpose of stopping the loom when not woven in, as specified."

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14. For an improvement in *Bridges;* Albert Cottrell, Newport, Rhode Island, November 10.

This improvement consists in supporting the bridge during the process of construction, as well as after completion, by the application of a counter-balancing power, which consists of stone laid upon a part of each end of the bridge, projecting in rear of its abutment, thus preventing a depression, or sag, of the bridge, as is the case with all wooden structures of this kind, and at the same time giving to the bridge the appearance of a very flat segment, or arch.

Claim.—"I shall claim projecting a bridge over a river without the aid of centering, staging, or supports, as required by ordinary bridges, by the application of stone, or other suitable counter-balancing material, on the top of a portion of the same, and in rear of the front wall of one abutment, thus supporting and securing the bridge on the abutment, as its parts are progressively combined together, and built over the stream towards the opposite side thereof. Also preventing the bridge from sagging in the centre, and giving a flat curve to the same, by loading both ends thereof with stone, the whole process being substantially as described."

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15. For improvements in the *Cooking Stove;* Almond D. Fisk, assigned to Nelson W. Fisk, New York City, November 10.

Claim.—"What I claim is, first, the manner of arranging and combining the lift-out pieces, by which the boiler holes are formed, so as to admit of their being so arranged that a long boiler may be placed in four different situations, by the proper disposition of the said lift-out pieces, in the manner and for the purpose set forth. Secondly, I claim the particular manner described of constructing the hinged feeder for the supplying of coals to the fire grate. Thirdly, I claim the particular manner in which I have formed the heated air chamber under the fire chamber, between the back plate of said fire chamber, and the front plate of the oven, and in part under the oven, into which air chamber the gaseous products of combustion pass through the descending flues, on their way to the centre ascending flue; the respective parts named being combined with each other substantially as described. I do not claim the arranging two descending and one ascending flue in the rear of the oven, as of my invention, such flues having been before used; but I limit my claim to the combination of them with the heated air chamber in the particular manner and for the purpose made known."

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16. For an improvement in the construction of *Vessels with Air-Tight Trunks,* to prevent them from sinking; Richard McDonald, Harrisburg, Dauphin county, Pennsylvania, November 10.

The nature of the alleged improvement is fully expressed in the following—

Claim.—"What I claim as my invention, and desire to secure by letters patent, is enclosing the spaces under the wheel guards of the boat, and filling them with air chambers, in combination with the arrangement of air chambers over the keelson, and under the deck, to prevent them from sinking when snagged, or otherwise injured, as described."

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17. For a *Corn Sheller;* Joseph H. Derby, Leominster, Worcester county, Massachusetts, November 10.

The corn in this machine is shelled by being forced through a sheller by means of a piston worked up and down by a treadle; the sheller is made of several flat pieces of steel brought to a point at one end, and set in a circle with the pointed ends up, a little inclining to the centre, around a hole made in a thick piece of board, left thicker where the hole is, and thinner round the edges. The sheath is placed between the sheller and the piston when up, and is for the purpose of receiving the ears of corn one at a time, and guiding them whilst under the action of the piston, which forces the cob through the sheller, the points of which strip the grains that fall into a box surrounding the sheller.

Claim.—"I claim as my invention the combination of the piston with the sheath and sheller, constructed and arranged in the manner set forth."

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18. For improvements in the *Air-Pump;* Joseph Milnor Wightman, Boston, Massachusetts, November 10.

The piston of this air-pump is connected with the plate by means of a hollow stem, or piston rod, and the upper end of the movable cylinder is provided with an air-tight cap, or cover, and stuffing-box, the cover, or cap, being provided with a valve opening upwards. Instead of attaching the piston rod, or stem, directly to the pump plate, a reservoir, called a "safety box," is placed between the two to receive and hold water, or any other substance, which may run down from the receiver. The upper end of the stem is covered with an inverted cup, and the holes for the passage of the air into the hollow stem are made directly under this cup.

Claim.—"I disclaim all right, or title, to the combination of a simple lever, movable barrel, fixed piston, &c., constituting a single barrel table air-pump, provided the barrel is open, and the top of the piston exposed to the open air. I also disclaim all right, or title, to the tight cover, packing box and piston, as described, if applied to, or combined with, fixed barrels and movable piston, whether operated by means of a simple lever, or otherwise; But what I claim as my invention, and desire to secure by letters patent, is, first, the combination of a tight cover, packing box, valve and piston, as described, with the top of the barrels of all air-pumps, so constructed that the barrel is moved upon a fixed piston combined by a hollow rod with a receiver, and by means of a simple lever, or other convenient power, and in which the operation is such that the act of exhausting the receiver presses the pump down upon the table, stand, or floor, upon which it is placed without regard to the particular form, or size, of the pump. Second, for the application of a safety box, as described, placed between the pump plate and the barrel of all air pumps with either fixed, or movable barrels."

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19. For an improvement in *Platform Balances;* Thomas Y. Jennings, Geneva, Ashtabula county, Ohio, November 10.

Claim.—"What I claim as my invention is the method of combining the two levers so as to lessen the friction at the points where they come in contact, by employing a roller in a cup, or concavity, on the surface of the long lever, upon which the lip, or extremity, of the short lever closes in such a manner as to work easily upon it, at the same time preventing, by the peculiarity of its construction, the escape of the roller, all as set forth."

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20. For a machine for *Slitting Timber,* in making laths, splints for baskets, chair bottoms, &c.; Benjamin Beach, Clarksville, Clinton county, Ohio, November 10.

The timber to be slitted is put upon an appropriate horizontal frame, on which slides a carriage adapted to the reception of two, or more gates, or frames, containing the knives, to one of which is attached a number of lancet formed cutters, placed at distances apart equal to the width of the splints to be cut, and to the other the knife for separating these from the block, which last mentioned knife is attached to a rocking shaft that it may adapt itself to the direction of the grain of the wood; the dividing knives, of course, precede the separating knife.

Claim.—"What I claim is the attaching of the knife, or knives, by which the stuff is to be cut into splints, laths, or slabs, of greater width, for various purposes, upon a vibrating, or rotating, stock, crossing a frame which slides vertically, so that said knife shall adapt itself unobstructedly to the varying direction of the grain of the timber in the manner described; I claim also, in combination therewith, the manner of employing the additional gate, or gates, furnished with cutting gauges, or knives, by which the splints, or strips, may be reduced to a determinate and regular width, as set forth."

21. For an improvement in the *Graduator for Measuring and Drafting Garments;* Lewis Flenner, Philadelphia, Pennsylvania, November 10.

The following claim will be sufficient to enable those who are acquainted with the art of drafting coats, to understand fully the improvement, viz:—

Claim.—"What I claim is constructing one arm of the graduator with a diagonal edge on its inner side, diagonal divisions on said leg, the other arm, or leg, being graduated in the manner set forth; also the employment of said graduator, so constructed, in combination with the shoulder and centre measures, for drafting garments, the same being applied and operating in the manner described."

The graduator to which this improvement is applied, is a graduated square well known to the craft.

22. For an improvement in the *Molasses Gate;* Levi Lincoln, Hartford, Connecticut, November 10.

The gate, or valve, instead of sliding, as heretofore, turns on a pin on an arm projecting from the side of the screw tube, and the handle by which it is moved, slides between two plates—the outer plate and the pin on which the gate turns being provided with set screws to keep the gate tight against the end of the screw tube, and thus prevent leakage.

Claim.—"What I claim as my invention is the combination of the lever (the gate) with the segment (the two plates between which the handle of the gate slides,) adjustable by the screws, as set forth."

23. For an improvement in the *Churn;* Thomas Pierce, Hartwick, Otsego county, New York, November 10.

The bottom of the box of this churn is semi-cylindrical, and the upper part square; and the beater, or dasher, is composed of four arms projecting from each end of a shaft, with their faces at an angle of about 45 degrees with the line of the shaft, the inclination at each end being reversed for the purpose of throwing the cream towards the middle of the churn. These arms are connected by means of staves in eccentric curves to direct the cream towards the shaft.

Claim.—"What I claim is the bevel of the arms in combination with the barrel form of the buckets to give the centripetal operation upon the cream.

To be Continued.

BIBLIOGRAPHICAL NOTICE.

An Elementary Treatise on Mineralogy, comprising an Introduction to the Science. By WILLIAM PHILLIPS, F.L.S., &c.; *Fifth Edition, from the Fourth London Edition. By* ROBERT ALLAN; *containing the latest discoveries in American and Foreign Mineralogy: with numerous additions to the Introduction. By* FRANCIS ALGER, member of the American Academy of Arts and Sciences, &c., &c.: Boston, William D. Ticknor & Co., 1844. pp. 662.

This work, published in Boston the last year, is compiled in part from the fourth London edition of the standard work of William Phillips. The last English edition, edited by Robert Allan, Esq., six years since, sustains the high reputation the original treatise has always held, among scientific men abroad, as well as the few in this country who were familiar with it, it has been considered the most valuable publication on mineralogy. To adapt it to the use of the American reader, it was necessary to add largely to the localities cited, as also to introduce the numerous new species, with their analyses, and forms of crystals. Fortunately this work fell into good hands, for the American editor, Francis Alger, Esq., of Boston, has devoted many years to the pursuit of general science, and more especially to mineralogy and geology, and has enjoyed the best opportunities that extensive personal observation, a valuable cabinet, and a wide scientific correspondence could afford. As the additions he has introduced make up about one half the number of pages, it might with propriety, we imagine, have been published as an original work, based on Allan's late edition: and as Mr. Alger has now so successfully entered the field as an author, we hope that in his next appearance he will assume a more independent title-page. But if we are disposed to find fault with Mr. Alger's modesty in this respect, we would highly commend it and his good taste too, in that instead of adopting the present common course with scientific writers of seeking to make out an original treatise, with its novel and cumbrous new system, burdened with strange and hard names, whose existence is fated to be as ephemeral as the systems to which they belong, he has been contented to follow that order of arrangement which common consent among scientific men generally acknowledges to be the best, and has given us the classification of minerals based on their chemical constituents. A perfect system of classifying minerals has not, it is admitted by all, been attained, and therefore we consider ourselves, who go not very deep into the niceties of these matters, to be rather more safe in following authority the most generally admitted, to selecting one of the less understood novel systems; and this conclusion appears to be substantiated by the immediate reception of this work as a text book in colleges and schools, particularly in Harvard University, and also by the high encomiums passed upon it by disinterested judges.

After all it is not the mode of arranging species that strikes us as the great important point to be attained to complete their description, though such seems to be the principal aim of the science of this day. For ourselves, we look upon the great object of these scientific text books to be of a more *practical* character, not merely to please the deeply initiated by the exact and critical relations of species with one another, but to give to the tyro, or the man of business, who refers to them, the most ready information as to the nature and uses of the different minerals. His eye, as it turns to the head of each page in this work, meets the intelligible terms "*Earthy Minerals*," "*Metalliferous Minerals*," etc., and he understands at once the general nature of the species beneath. And in the "*Table of Mineral Species*," he finds their atomic composition, their hardness, and specific gravity expressed in the simplest forms. But with regard to this table, we cannot help suggesting what would be for us a great advantage in searching out the name of unknown specimens, and this is to adopt a similar arrangement to that found in some other works, placing the species of each class in an order corresponding to their hardness, or to their specific gravity, that we might be led at once to limit their place within a narrow range; and if the color of the streak, and action before the blowpipe, and with acids, etc., could be brought into the same tabular arrangement, we are confident the work would be sought for in preference to others that are now referred to for the sake of similar tables, though in other respects they contain much to excite a distaste to the whole subject.

But a few words more concerning the arrangement adopted in this work. As minerals vary by insensible graduations, one atom, and another of one or more of their constituents being replaced by other elements, it is most unlikely that all could ever agree as to their proper places in any system. Their very nature seems to render an universally received mode of arrangement out of the question. Logicians may more easily resolve the long mooted question of the pair of hose, that were so repeatedly darned as to lose all their original threads—whether these remained the identical pair purchased by their owner, and if not, when they ceased to be so—as mineralogists to agree in their classification. In this science, however, there appears to be one advantage that does not extend to the hose, namely, that the threads, or elements, being united in certain definite proportions, or atoms, if so much of one of them is replaced by another as amounts to one of these atoms, the compound is considered as having assumed a new character, and is thus entitled to a new place and name; but when the replacement is too minute to be so estimated, the change is very properly considered by Mr. Alger accidental, and is not regarded. For example, condrodite, or broncite, contains sometimes two per cent. of potash, but this never amounting to an atom, it remains classed with the earthy minerals, while the feldspars, always containing an atom or more of potash, or soda, belong to the alkalino-earthy minerals.

The formulæ representing the atomic constitution of the minerals are determined by the equivalents of their elements, as given by Thomson. These atomic weights differ little in their relative proportions from those of Berzelius, Thomson's being calculated from oxygen reckoned as one, and Berzelius' tables from oxygen reckoned as one hundred. Those of the former are all simple multiples of the atomic weight of hydrogen, the original views of Prout in this particular being sustained, as we are informed in a note, by the farther investigation of Dumas, Marchand, and Erdmann. By dividing the per centage results of each constituent obtained by analysis by the combining proportion of oxygen with the same substance, numbers are obtained which indicate the atoms of the different constituents of the mineral examined. The same result is also attained by dividing each by its atomic weight as given in the tables; and this latter is the method adopted in the work itself. This process, though sufficiently explained, seems rather to belong to the operative chemist than to the student of mineralogy, and therefore we are not to expect to find here a very minute description of it, nor the tables which have been contrived to exemplify it.

The formulæ given in the work are principally the *mineralogical*, in contradistinction to the *chemical*. Beudant says of them, that it must be confessed they are less satisfactory than the chemical,—"il faut avouer quils sont moins satisfaisants pour l' esprit que les signes chimiques, et par cela même plus difficiles á retenir et á comparer les uns aux autres." As this subject of signs is one of the most intricate and the most difficult for the student to comprehend sufficiently to avail himself of their valuable aid, we are disappointed that in introducing them into his work, Mr. Alger had not devoted a longer chapter to a complete explanation of them, making plain by numerous examples the difference between the two kinds of signs, and the method of converting one into the other, and finally in the body of the book, gives not only the mineralogical but the corresponding chemical formulæ. For as the book is intended to be a complete elementary treatise, it must fall into the hands of many who have no other means of learning this most important branch of the science, and would naturally look for full information concerning so important a topic in this place.

The same remarks might be applied to the sections on *isomorphism* and *dimorphism*, phenomena as yet little familiar to scientific men, though they appear to play important parts in the composition and outward forms of minerals. The two short sections devoted to them contain a great deal for four pages, but they do not satisfy us, nor do they seem to satisfy the American editor, who states at the close of his remarks, that the former editions of the work contained no reference to the subjects, and that he had endeavored to give the most important facts in relation to them, though their omission was not observed in time to be supplied in an earlier part of the introduction. We trust, therefore, in another edition to hear more of these topics.

While we are alluding to what appear to us deficiencies, we might add, that as no one would be better able, from practical knowledge and experience, to compile an interesting chapter on the *uses of minerals* than Mr. Alger, we cannot but hope to see such appended to future editions of the work. A similar paper to that forming the last chapter in the first volume of Beudant's treatise, would, we are sure, be quite as interesting, and much more generally read, to say nothing of its *practical* importance, than the excellent article on the forms of crystals. For without at all undervaluing the aid that an exact knowledge of this subject may impart in distinguishing similar species, its use is necessarily of so refined a nature, and requires so exact an instrument to determine the angles, that but few skilful scientific men will be likely to avail themselves of it. Even Mr. Alger, it seems, in order to leave no doubt as to the identity of *beaumontite* with *fleulandite*, "requested Mr. Teschmacher * * * * * to subject the crystals to measurement by the reflecting goniometer." The general reader and student will be much more likely to be deprived of the means of availing himself of the assistance of this delicate instrument, and of the full benefit to be derived from determining the angles of the crystals. As the arts are every day becoming more matters of science in this country, and practical men are turning from empirical methods of operating to the benefit derived from and through knowledge of the materials they use, and consequently look to works on mineralogy for a complete description of all useful minerals, we think that an article from the able pen of Mr. Alger on the subject we have referred to, would well please a large class of readers. It is true, there is no lack of description under the head of each species; under that of *Iron Ores*, as well as of *Coal*, we are pleased to find much more valuable information than is usually met with in works on mineralogy; but in the account of the *Limestones*, there are hardly any allusions to their practical importance, and one might look in vain for information concerning the various uses of the different varieties. Connected with the working of iron ore, limestone is almost as important as the ores themselves, and the adaptability of the different kinds of limestone for this purpose, as well as for the manufacture of hydraulic cement, &c., might properly demand some attention. So of all other minerals that are put to useful purposes.

We notice that several analyses have been made expressly for this work, and that they were of minerals of rather doubtful character, which required exact chemical examinations to place them in their true position. *Sillimanite*, which had been considered a compound of silica and alumine with zirconia, has been proved by the analysis of Mr. Hayes, to contain no zirconia, thus making its composition agree with that given it by Bower. *Washingtonite* of Shepard, by the analysis of Kendall, is shown to be a variety of *Ilmenite*, similar to that analyzed by Mosander. And by the analysis of *Stellite*, by Mr. Hayes, the three minerals *Stellite*, *Pekolite*, and *Wollastonite*, appear to be the same, the water being considered accidental.

By means of other analyses recently made, some new species are added to the catalogue of minerals of very interesting character, as *Hayesine*, or *Borocalcite*, *Pickeringite*, &c. The former of these, named by Mr. Alger in honor of the analyst, is a salt found associated with various other saline substances in Tarapaca, Peru; it consists of three atoms of boracic acid, one of lime, and six of water, being a hydrated ter-borate of lime. "It occurs in globular masses of a fibrous structure, having externally a brown color; when broken these masses appear to be formed of snow white delicate fibres, interwoven, curved, and knotted; the lustre being satin-like, and the fibres so soft as to crush readily between the fingers. Placed in warm water it expands and forms a consistent paste, and exhibits numerous tufts of radiating fibres. It dissolves in dilute nitric acid, and the solution poured into a large quantity of ammonia, produces a precipitate which soon redissolves in the alkaline fluid. In moist air it attracts moisture, and exhales a peculiar odor. B. B, it intumesces, and gives off water; contracting, it becomes white and opaque. More highly heated it melts, and with continued bubbling, gives a clear white glass; with its bulk of soda it gives a glass which is clear and colorless while hot, but becomes opaque and crystaline on cooling. It encloses fragments of argillaceous slate with brilliant and perfect crystals of glauberite, which are sometimes penetrated by the fibres of the borate.

This is the first known occurrence of this rare salt in the mineral kingdom. It is found associated with various other saline substances in the Province of Tarapaca, Peru, and was brought to the United States by Mr. T. H. Blake, to whom we are indebted for much new and valuable information in relation to the rich mineral districts of Chili and Peru."

Pickeringite is "an extremely beautiful mineral, occurring in masses composed of long parallel fibres of a silky, or satin, lustre; color from white, or viewed in the direction of the fibres, pale rose red, or light green; compact, but easily divided parallel with the fibres; brittle; specific gravity 1.78 to 1.80. It swells when heated, and the white mass which remains tastes like alum. Its analysis afforded Mr. A. A. Hayes the following results:—

Water of crystalization, .	45.450
Sulphuric acid, . . .	36.322
Alumina, ...	12.130
Magnesia, ...	4.682
Protoxide of manganese and iron,	0.430
Lime, ...	0.126
Muriatic acid, . . .	0.604
	99.744

This mineral appears to be a very pure native magnesian alum, and very nearly answers to the composition of a magnesian alum from South Africa, analyzed by Stromeger. * * * * *

It occurs abundantly in the province of Tarapaca, in Peru, associated with glauberite, hydro-borate of lime, and *iodate of soda*, hydriodate of soda, sulphate and biborate of soda, chloride of sodium, and organic matter."

The massive scapolite rock of Hitchcock, found at Canaan, Connecticut, is lately discovered by Dr. Dana, of Lowell, to be a new combination of lime, alumina, silica, and protoxide of iron, and he has given it the name of *Canaanite*.

To Mr. Alger is due the credit of proving the identity of the *Lincolnine* of Hitchcock with the *Beaumontite* of Levy, and both these are now returned to their proper place as varieties of *Heulandite*.

The mineral *Ledererite*, which has been supposed by some to be identical with *Smelinite*, Mr. Alger has shown cannot be the same, inasmuch as it contains phosphoric acid, as an essential constituent part united with the lime; and this, therefore, retains its place as a distinct species with the formula given it by Berzelius, based upon its analysis by Hayes. Not only is the existence of the phosphoric acid, which is considered by Mr. Hayes and Mr. Alger, and apparently by Berzelius also, as well as by Rammelsberg in his Handwörtenbuch, essential to its composition, but in hexahedral cleavage is also opposed to its being identical with chabasie, whose primary form is an obtuse rhomboid.

In some of the editorial notes we find interesting notices of different minerals, two of which it may be well to transcribe. One is in relation to the mineral *Condrodite*, frequently called *Brucite*, (though it would seem this latter name ought rather to be given to the hydrate of magnesia, which was actually discovered by Dr. Bruce.) This *Condrodite*, though found in only two localities in Europe, one at Pargas, in Finland, and the other in Sweden, occurs in fine specimens in Orange county, New York, and in several localities in New Jersey. The editor remarks on its history as follows:—"There is no mineral in the whole range of the science that offers a more interesting history than the present species, considered in reference to its chemical nature, and it is to American mineralogists and chemists, that we owe our most important knowledge concerning it. Dr. Langstaff, of New York, was, unquestionably, the first to detect the presence of fluoric acid in the New Jersey mineral,* while Mr. Seybert, of Philadelphia, has the honor of having first discovered it in the Pargas variety,† in which it seems to have been overlooked both by Berzelius and D' Ohsson, who had examined it; but Dr. Langstaff's results had not become generally known, when, in 1822, and previous to his examination of the Pargas mineral, Seybert‡ announced his discovery of fluoric acid in a specimen from New Jersey, without the least knowledge, as he declares, of what had been done by Langstaff. He had inferred from their characters, that brucite and condrodite were different minerals, though Berzelius had viewed them as identical; but the result of his examination was finally to show the existence of fluoric acid as an essential constituent of both, and to establish their identity. Soon after, Dr. Thomson made known his analysis of the New Jersey mineral, and fully confirmed Seybert's. Thus it appears that Seybert, equally with Langstaff, was the discoverer of fluoric acid in condrodite. It should be added that several years before Seybert had announced his discovery,—Dr. Torrey, of New York, read before the Lyceum of Natural History, his analysis of brucite, in which he had found a large portion of silica, and proved the mineral to be a fluo-silicate, and not simply a fluate of magnesia, as it had been regarded by many of our mineralogists, and under which name it was mentioned in the first edition of Cleaveland's Mineralogy. At this time he was not aware of Langstaff's prior experiments. The analysis by Berzelius I have not been able to find; Langstaff obtained silica 32, magnesia 51, oxide of iron 6, fluoric acid 9, water 1. It was at first supposed to be sphene by Dr. Bruce, the original discoverer of the mineral in the United States." There are six analyses of the above species given in the text.

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* The date of this discovery is 1811; Amer. Journ. Science, vol. vi, p. 171.

† Amer. Journ. Science, vol. v, p. 336. ‡ Ib. vol. v. 336.

The note to page 168, is equally interesting to American readers, showing to us that more than twenty years since our chemists were as exact in their researches as the most celebrated of Europe. After describing the *Chrysoberyl*, we have this account of the discovery of its real character.

"It is to the sagacity of an American annalist, *(analyst)* Henry Seybert, that we owe our knowledge of the true nature of this mineral. In 1822 he analyzed the Haddam and Brazilian chrysoberyl, and detected in both the presence of glucina, though the latter had been previously analyzed by Klaproth and Arfwedson, both of whom had overlooked that substance. Dr. Thomson has more recently verified the result obtained by Seybert, which is the more important, as Beudant has adopted the analysis of Arfwedson, though aware of what Seybert had done; and others seemed undetermined as to the true nature of the mineral. I have thought it proper to record each of the several analyses which have been made, and it appears from them not a little extraordinary that while the analysis of Dr. Thomson showed that this mineral contained no silica whatever, Arfwedson should obtain nearly nineteen per cent. It is evident that the latter not thinking to look for glucina, confounded this earth with alumina; but it seems scarcely possible that he could have mistaken glucina, or alumina, for silica. The mineral has not been analyzed by Berzelius, but H. Rose has confirmed Dr. Thomson's results in proving the absence of silica; we are thus equally indebted to Seybert and Dr. Thomson for our most accurate knowledge of the chemical constitution of this species."

With these extracts we close our remarks upon this interesting and highly creditable work to American science, only repeating our hope that if Mr. Alger should ever publish another edition, he would finish the work he has now only half done, and *thoroughly* Americanize the book. It needs some little revision, some correction of typographical errors, and an expunging of a few obsolete words, or terms, now little used, as "greywacke," &c., which, if familiar to the scientific men of Europe, have no definite meaning here; and if in following too closely a foreign author, some of his errors should have remained attached to the work, as in placing our favorite *Meerschaum* among the earthy carbonates, instead of giving it its real siliceous character, we have reason to believe that if Mr. Alger should come forth on his own responsibility, all these would disappear, and his book would take a still higher rank, than the present edition, among the standard publications on mineralogy.

FRANKLIN INSTITUTE.

On Rickett's Improvement in the Piano Forte.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom was referred the examination of the improvement (so called) in the Piano Forte, by Lovering Ricketts, respectfully Report:—

That they have examined with care the piano exhibited to them by Mr. Lovering Ricketts, and find the alleged improvement to consist of springs to which the strings are directly attached. In the language of his patent, his claim consists in the "application of my metallic springs to the piano, harp, and all other musical string instruments, as an improved substitute to the common hitch pins now used, and for the purpose of giving elasticity to the strings, and for keeping them in tune for a long period of time."

In the piano examined by the committee, blocks of metal are inserted into the plate of the instrument, to which horizontal springs are attached, and the strings are hooked upon the ends of these springs, so that when the strings are tightened by the turning of the pins when the instrument is tuned, the strain bends the springs until the resistance is such as to maintain the string at the degree of tension necessary to sound the desired, or proper, note.

On examination it was found that the springs operated, according to the views of the patentee, as the strings were strained by the tuning pins, they slipped by the pins of the bridge, and drew the springs until the tension was equalled by the resistance necessary to produce the required note, and that upon turning the tuning pins backward the springs drew the strings back, and the note fell as the tension diminished; thus showing that the operation of the springs was, so far, satisfactory.

It is probable that the views of the patentee are correct in the supposition, that the construction of a piano on this principle will enable it to remain in tune a longer time; or, more exactly to express the views of the committee, it will go out of tune more gradually than those of the usual construction; but this assertion is entirely comparative; how much slower, would require a careful comparison with other instruments of the same general construction, and a similar grade of workmanship and material: that it will go out of tune from all the usual causes is beyond a doubt, as those causes will affect the instrument under consideration in the same manner, and to the same extent as any other, such as constant tension upon the string itself, the expansion, or contraction, from changes of temperature, and the general yielding of the wood work forming the body of the instrument.

There is reason to doubt the purity of tone to be derived from a string, the strain of which is supported in the manner described by the patentee.

A light blow of the hammer it is probable would not affect the spring, and a perfect vibration would be produced, but if a heavy blow should be given, and "repeated," as is usual in the modern style of playing, is it not evident that the spring would yield, and as a consequence, the length of the string be augmented between the bridges, producing, for the time being, a note, or chord, out of tune. And again, suppose, what is so usual in music, a light passage in the treble, not affecting the springs, in that part of the instrument, and a heavy, or loud, chord on the bass acting powerfully upon the springs, the bare supposition is a dissonance too great to be borne with composure, and that such is the fact the committee have abundant evidence.

This inseparable disadvantage must be increased by perfection of workmanship, and the improved action of the spring consequent therefrom. Mr. Ricketts' instrument appears to have been got up in haste, and is not, therefore, amenable to this remark in its greatest extent.

In the claviole of the ingenious John I. Hawkins, an instrument of extraordinary power and beauty, a combination was attempted by which the effect, expression, and compass of the violin, tenor, bass, and double bass, in short, the stringed quartette was to be brought under the hand by means of the ordinary finger-board of pianos and organs. In this instrument a difficulty occurred which taxed, to their fullest extent, all the inventive powers of this extraordinary man—and that was the maintenance of the proper degree of tension of the strings made of animal tissue, a well known difficulty in all instruments of music in which these kinds of strings are employed—hygrometric changes, as well as those of temperature, affecting them rapidly, and to a great extent.

This difficulty Mr. Hawkins attempted to meet by the introduction of springs, to which the strings were attached, so as to maintain a tension proportionate to the changes, hygrometric and otherwise, which always affect these means of producing musical tones. His singular sagacity must have been severely tasked, as we have evidence that he introduced progressive lever arrangements in conjunction with springs, on the general principle of the fuzee of the watch, in the endeavor to meet the contingencies of the case. These and other difficulties have doubtless hitherto prevented the adoption of an instrument, which, if it could be perfected, would be of incalculable value to the musical world. The same mechanical genius made pianos with spiral metallic springs, which sustained the tension of the strings, one of which was used in this city, with all the disadvantages which have been noticed in the foregoing paragraphs.

The general inference which is to be drawn from this report, is decidedly unfavorable to the alleged improvement; as it regards its novelty, we have to add, that besides its general principle, as employed in the claviole and piano forte of Hawkins, we have evidence that pianos were made in Liverpool, to the strings of which ordinary springs were attached, one of which was sold in this city.

These facts and circumstances relate to a period of time about one third of a century antecedent to the date of this report.

By order of the Committee, Wm. Hamilton, Act'y.

Philadelphia, December 12th, 1844.

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Chemical Reactions produced by bodies which intervene only by contact. By E. MITSCHERLICH, (Ann. de Ch.)

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

(Continued from Page 197.)

We may better comprehend the action of bodies which affect each other by their contact, when we study the cases in which decomposition is effected. If ammoniacal gas is passed over turnings of copper, or iron, incandescent, it is completely decomposed into azote and hydrogen gases,—whilst, in passing it, at the same temperature, over platina turnings, or fragments of glass, it is not decomposed except in extremely small quantity.

The decomposition of the binoxide of hydrogen is of the highest importance; it takes place only at the surface of solid bodies, and in proportion even to the extent of that surface; but bases and acids act upon it in very different manners: the former provoke the decomposition of the binoxide of hydrogen, the latter render it more stable.

The decomposition of the chlorate of potash in contact with the oxide of copper, the binoxide of manganese, and other oxides of this kind, is also a thing of particular interest. When we heat chlorate of potash it melts, and at a higher temperature it is transformed into oxygen, chloride of potassium, and into hyperchlorate of potash, which, in its turn, is decomposed into oxygen and chloride of potassium; but if, instead of heating the chlorate of potash alone, we previously mix it with one of the oxides I have just mentioned, it is transformed into oxygen and chloride of potassium at the temperature of fusion, without the production, in this case, of hyperchlorate of potash.

To give an exact account of the action of the oxides, in this case, we may perform the following experiment:—Put into a stoppered tube a mixture of oxide of copper and chlorate of potash, and into a second introduce chlorate alone; furnish them with bent tubes for collecting the gases, and place them together in an alloy bath. At a certain temperature the chlorate mixed with oxide is completely decomposed, whilst the simple chlorate has not yielded a trace of oxygen. By mixing chlorate of potash with silica, it is decomposed absolutely like chlorate alone.

The decomposition of chlorate of potash is accompanied by a development of heat. This phenomenon is witnessed during the decomposition of the binoxide of hydrogen. It is to this heat, or rather to the cause which developes it, that we are to attribute the simultaneous decomposition of oxygenated water and oxide of silver, as well as other oxides which lose their oxygen at an elevated temperature.

The transformation of lignin and of starch into dextrine, and that of dextrine, of gum, and of sugar, into glucose, is produced by a liquid body.

We know that in boiling starch with dilute sulphuric acid, it is promptly converted into dextrine and glucose. At whatever period of the operation we may examine the liquid, we find in it free sulphuric acid, and always in the same quantity; but the reaction, which consists in a simple fixation of water, goes on the more rapidly the more sulphuric acid is employed.

We may effect the same transformation by using nitric acid, and thus obtain an intermediate product which possesses some interest. Take, for example, forty parts of dry starch, and moisten it with one and a half parts of water, and then add two per cent. (of the starch,) of nitric acid—leave this mixture to dry, at first in the open air, and then in a water bath. The dry mass is to be dissolved completely in water, and in using but five parts of water to one of starch, the solution gelatinizes on cooling. In this state it much resembles dissolved starch (empois) that many of the masses supply, and which is commonly prepared from lichens, or seaweed. If this solution be boiled a long time, and especially if a little acid be added, it loses the property of gelatinizing. The formation of dextrine and glucose is due to the fixation of water determined by the action of the acids.

The conversion of starch into dextrine may also be effected by the aid of a temperature of 150°. Thus the acids and heat operate precisely like platina and heat in the combination of hydrogen and oxygen. Diastase, at the temperature of 75°, acts, with respect to starch, like acids. As this substance has not hitherto been obtained in a state of purity, we cannot prove that it has not undergone some alteration during the transformation of starch; and yet, since the reaction is effected by so very small a quantity of diastase, even when impure, we may reasonably admit that it acts only and truly by contact.

A few hundredths of sulphuric acid added to a solution of cane sugar, is sufficient, even in the cold, to change it to glucose, and to enable us to prove its existence in the fluid by sulphate of copper and potash. Other acids transform it also in the cold. Acetic acid does the same, but only when hot.

It is for this reason that lime is added to the saccharine juice of plants when cane sugar is to be extracted. I have examined the juice of beets, and have always found it perfectly neuter, so that the transformation we have spoken of is impossible in the beet itself; but every wound may become the cause of the production of acids, and then the sugar is subjected to alterations.

I have obtained the sugar derived from the action of sulphuric acid on cane sugar in the state of crystals. The sugar obtained by adding beer yeast to a solution of cane sugar, appears to differ from grape sugar. I have not been able to obtain it crystalized, and it rotates polarized light much less than an equal quantity of grape sugar. Its formation is very remarkable; it is owing to a substance mingled with the globules of ferment; it is the aqueous solution of this material which determines the change of cane sugar into this new kind of sugar. On this account fermentation takes place much more slowly in a solution of cane sugar, when washed yeast is employed instead of common yeast. In the former case, give common yeast the time necessary for a part of it to become transformed into this soluble body. Common yeast excites fermentation as quick in a solution of cane sugar, as in one of glucose.

This kind of sugar differs in other respects from that obtained by melting cane sugar.

In melting cane sugar at a temperature of 160 degrees, it becomes completely deliquescent, dissolves in absolute alcohol, ferments when put in contact with a ferment, and exerts on polarized light much less influence than that of grape sugar.

Cane sugar, after being melted, no longer crystalizes; but if melted with water, care being taken not to raise the temperature above 154°, it produces, on cooling, a vitreous mass, composed chiefly of cane sugar and water mechanically enclosed. The latter dissolves the particles of sugar one after another, and deposits them in crystals, for an amorphous body is more soluble than a crystalized body. The whole mass passes to the crystaline state. It is easy, in breaking a stick of such sugar, to perceive the presence of water, especially near the centre, and among the crystals. It is possible that this sugar may be identical with that procured by keeping a solution of cane sugar a long time at the temperature of 110°, and which, according to M. Fensky, exerts no action on polarized light. Perhaps it is identical also with that which M. Peligot and M. Mulder, procured by boiling cane sugar a long time with dilute acids, and which, they say, does not crystalize.

Chemists are agreed relative to the changes which glucose and other kinds of sugar undergo during fermentation. It is generally admitted that carbonic acid is formed with a third part of the carbon of the sugar, while the remaining two-thirds unite with the hydrogen and oxygen to form alcohol. Thus for one measure of carbonic acid, one measure of alcohol is produced; but, according to the kind of sugar, there is an elimination, or a fixation, of water; the first case presents itself in glucose, the second with the variety of sugar soluble in alcohol. The body which determines this action, the only means by which it can be produced, is an organized body.

We may, without entering into a detail of the opinions to which this phenomenon has given rise, discuss the facts which alone possess any interest in this question. Ferment is composed of oval and round globules; these globules are large enough to be retained by filtering paper. If we put a small quantity of ferment into a tube closed at one end with blotting paper, and introduce it into a solution of sugar, the latter passes through the pores of the paper, and undergoes the alcoholic fermentation, but only in the tube which contains the ferment. The fermentation goes on in the solution in which the tube has been placed only after a longer, or shorter, period, and always under the influence of globules of ferment, which eventually pass through the pores of the paper, which softens by its prolonged contact with the liquid. This experiment plainly proves that fermentation goes on only at the surface of the globules of ferment.

I have made other experiments which prove what has just been advanced. M. Schwann has made others, but they are not so decisive as those just stated. I have never seen fermentation without globules of ferment, and the phenomenon always appears at the surface.

It requires but one per cent. of globules of ferment to effect the complete transformation of sugar into alcohol and carbonic acid, and when we use globules perfectly organized, they undergo almost no change during the fermentation. When destroyed they are no longer effective. In placing them in contact with bodies which have the property of arresting fermentation, we perceive them to contract when examined by the microscope, at the moment of touching these bodies.

Globules of ferment therefore when mingled with sugar, or sugar and water, which contain the elements of carbonic acid and alcohol, act precisely like spongy platina, with respect to oxygenated water.—Naturalists, occupied with the study of the most simply organized beings, declare that globules of ferment ought to be ranked among them; and, in reality, considering their generation and development, we can come to no other conclusion. Thus, generation always takes place in the fermentable juices of plants, and before fermentation commences in them.

It is only at the end of three days that we remark in these liquids microscopic points, isolated, or united into chaplets;—these points expand, and we may plainly perceive that their increase occurs from within outwards; and eventually we observe in their interior a granulated mass surrounded with a transparent envelope. They are often elongated, and then they exhibit two or three granular points.

By using perfect globules of ferment for exciting fermentation in sugar, I have not perceived them to develope; but by leaving the ferment for some time they are seen to ramify in the manner of confervæ. The organized beings that are formed in whey ramify in whorls. The sediment which occurs in whey in the course of a few days, is, like ferments, organized, but mingled very often with unorganized substances. Agreeably to several naturalists—MM. Schultz, Schwann, and others—these beings are not reproduced when access of air is prevented, and never when matter susceptible of being converted into ferment, are fed with air previously exposed to a red heat. This is one proof against *equivocal generation*, while the supposition that the origin of an organized being in a liquid springs from a point that escapes observation, leads to a conclusion favorable to such generation.

It would be important to know what these beings would become, if, instead of being developed in a liquid, their expansion took place in the open air. Would it result in a mucor, as M. Kutzing supposes? A mucor added to a fermentable liquid excites no fermentation, and moist ferment, long exposed to air, is not transformed into mucor.

The presence of these organized beings in the intestinal tubes of herbivorous animals possess a special interest; we may assure ourselves, by the method of M. Tromener, that there is grape sugar in an animal which has eaten vegetable food. It is found in the stomach, and intestinal tube, as far as the rectum only. We find great numbers of organized beings in these parts of the organism, but they disappear entirely in the rectum and in the fecal matter. M. Remac first drew my attention to this, and since then M. Purkinjes, M. Bohn, and my brother, have had occasion frequently to observe them. It is very probable that in addition to digestion, a true alcoholic fermentation takes place in the intestinal tube occasioning ventuosities. The blood which surrounds the intestinal tube, dissolves carbonic acid, which may be disengaged by the lungs without recurring to other modes. These organized beings, commonly of an elliptical form, have two transparent points, and sometimes enclose a granular mass like those of ferments.

MM. Boutron and Fremy have recently proved that lactine is transformed into lactic acid under the influence of caseum, and that this combines with the acid formed. Further, in separating caseum from its combination with lactic acid, by means of carbonate of soda, a fresh quantity of it is produced. The composition of lactic acid is such that it is represented by sugar of milk, minus a certain quantity of water. I have repeated these experiments with the same results; but, as in this reaction, a compound is formed of caseum and lactic acid, we must suppose that the affinity of lactic acid for caseum intervenes in the phenomenon. The coagulation of milk, however, in the preparation of cheese, seems to be owing to other causes, since rennet is commonly employed to produce it.

We generally suppose that it is the internal part of the stomach of the calf which causes the coagulation of milk. It is not so, however; the rennet that I obtained was prepared from mucus and the muscular membranes which are taken from the stomach, rejecting the peritoneum: but I could easily coagulate milk by making use of other parts of the peritoneum,—the part, for example, which covers the cæcum.

When we take the precaution to raise the temperature of milk a little, coagulation takes place in a few hours, either by suspending the membrane in it, or pouring into the milk a warm infusion of it. The membrane and its infusion have no acid reaction, and the milk remains neuter during its coagulation.

The chemical combinations which are established by means of substances which act only by contact, are very analogous to those which are produced, when, for example, one body combines with a second, and the resulting compound acts upon a third.

Sulphurous acid has more affinity for oxygen than the binoxide of azote; and yet sulphurous acid does not combine with oxygen when we allow the mixture of these gases to remain long in contact, whilst the binoxide of azote directly seizes gaseous oxygen to form hyponitric acid. The latter yields its oxygen to sulphurous acid to become again binoxide of azote. The oxygen then in hyponitric acid is in a state which enables it to combine with sulphurous acid. Putting a mixture of oxygen and sulphurous acid in contact with spongy platina, the two gases combine; the action of the platina is, therefore, in this case, the same as in hydrogen and oxygen.

All these processes, and especially the production of the ethers, and of the ether itself, lead to the conclusion that chemical decompositions and combinations may be prevented by the respective position of the atoms; but that the force of attraction which certain bodies exert on the atoms of those into whose presence they are placed, may change the position of them in such a way as to determine chemical reactions. The manner in which gases act with charcoal, and especially with platina black, proves that this attraction is very strong even with respect to bodies of different natures.

Berzelius gives to this force the name of *catalytic force*, with as much reason as we say force of affinity, &c., and understand by this denomination a force which is appropriated to many substances which do not enter chemically into the reactions which they excite, and whose activity consists in destroying chemical combinations. In order to affix a term to the phenomena, I have named these substances *contact substances, (contact substanzen,)* and the chemical process, a decomposition, or a combination by contact.

Notice of the Manufacture of Glass in Bohemia. By M. L. P. Debette.—[Annales des Mines, 4th series, volume iv, page 553; December, 1843.]

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

(Continued from Page 192.)

Chapter IX.—*Of Opalescent Glass.*

The milky-white glass imitating alabaster, or opal, is prepared like the fine colorless glass, only with the addition of a greater, or less, quantity of calcined bone powder, according as a more or less opaline glass is desired. A great quantity of opaline glass colored green, is also manufactured in Bohemia; formerly it was prepared by adding to colorless glass a certain quantity of calcined bone powder, yellow oxide of uranium, and oxide of iron, (finery cinder.)

This color is altered after long exposure to solar light. For some years past it has been replaced at Winterberg and at Silberberg, by a more beautiful color, due to calcined bone powder, yellow oxide of uranium, and oxide of nickel. The oxide of tin is employed solely in the manufacture of enamels, because it is far more dear than the calcined bone powder, (phosphate of lime—bone earth,) and because it requires a larger quantity to produce the same effect.

Chapter X.—*Of Hyalite.*

The name hyalite is given to a completely opaque glass, generally black, which is distinguished by a hardness and lustre truly remarkable, and forming a beautiful contrast with gold. It may without any inconvenience, be employed for the manufacture of vessels intended to hold boiling liquids, such as tea-pots, coffee-cups, &c., without any danger of its breaking. It was first made in 1820, at the establishment of Georgenthal, near Gratzen, and M. le Comte de Buquoi, who invented this beautiful product, has secured the invention to himself by a patent right. To prepare this black glass there must be added to the materials, for white glass, a certain quantity of poor forge cinders pulverized, charcoal dust in excess, and calcined bone powder.

It often happens either that the melting of the glass is not complete, or that the mixture, or the proportions, of the ingredients was not right. The glass obtained must then be calcined and quenched, powdered again, and remelted after having had added to it what may have been missing. The forge cinder may be replaced by basalt, or lava. If sufficient carbon has not been added, the glass takes a more or less deep green color, and presents, upon cutting, very regular mottling. The same is true of the more or less deep yellowish brown hyalite, which is obtained by replacing the forge cinder by the cinder from the argentiferous lead furnace of Gutwasser, near Budweis.

A red hyalite may also be obtained with calcined bone powder, oxide of copper, carbon, &c., and all these varieties present a marbled structure upon cutting.

The black color of hyalite may perhaps be explained in the following manner:—In the presence of an excess of silica, the oxide of iron is not reduced, but only brought by the carbon into the state of protoxide, and tends to color the glass deep green. The excess of carbon, probably by transforming the small quantity of alcaline sulphates present in the glass into sulphurets, tends, on its part, to color it of a more or less deep topaz yellow, passing even, in certain cases, to a purple red.

Now we know that we can obtain black by a mixture of green and red; the only difficulty then consists in employing the proper proportions of oxide of iron and carbon.

If the quantity of carbon is insufficient, the hyalite will take a greenish color, and will be composed of concentric zones having different shades, which may be made apparent by cutting. Should we attribute the formation of these zones to a devitrification analogous to that which is presented by many furnace slags, to an oxidation, or to a reduction which is propagated from without inwards, during the working and annealing of the glass? This is what cannot be decided without some experiments not yet made. All that we have here said relative to the black, and to the marbled green hyalite, applies equally to other hyalites; and, in short, we may say that hyalite is fit to take the place of porcelain in a great many cases, possesses far more lustre, and is capable of receiving a more perfect polish.

Chapter XI.—*Of the manufacture of Enamelled Cast-Iron Vessels.*

Iron pots, and especially those of enamelled cast-iron, are very extensively used in domestic economy. To enamel these vessels they are cleaned as perfectly as possible with weak sulphuric acid, then washed with cold water, and dipped into a thin paste, made with quartz first melted with borax, feldspar, and clay free from iron, reduced to an impalpable powder, and sufficient water to form a rather thin paste. These vessels are then powdered in the inside with a linen bag, containing a very finely pulverized mixture of feldspar, carbonate of soda, borax, and a little oxide of tin. Nothing then remains but to dry the pieces, and heat them in an enamelling furnace. The coating obtained is very white, resists the action of fire without cracking, and completely resists acid, or alkaline, solutions.

CHAPTER XII.—*Of the Cutting of Glass.*

All the fine glasses called Bohemian crystal are cut. For this purpose are used vertical wheels of iron, wood, or stone, moved by the foot, or oftener by a water-wheel by means of pullies and endless bands. The iron mills are used to rough-grind the pieces, water is fed to them continually by means of a shoe placed above, and below is a box containing sand, which the workman throws by hand upon the mill. The pieces are then passed to wheels made of sand stone, and then upon wooden wheels, first with the mud from the sand previously employed, then with emery finer and finer, and finally finished with jewellers' putty, which is often put upon a dry wheel covered with cloth coated with this substance. For some years past many articles have been made partly polished and partly mat. The mat parts are obtained by rough-grinding the glass in spots without polishing it. Hydrofluoric acid liquid, or gaseous prepared with two parts, by weight, of fluor-spar, and four parts, by weight, of concentrated sulphuric acid, is also often used for this purpose, or for engraving upon the glass; care is then taken to cover all the glass with a varnish formed with four parts of wax, and one part of essence of turpentine, which is then removed by a graver from the parts to be attacked.

CHAPTER XIII.—*On the art of Gilding, Silvering, Platinating, and Incrusting Glass.*

Gilding.—To gild glass they take gold nearly pure, which is dissolved in aqua regia, and then precipitated from its solution by caustic potassa, or better still, by protosulphate of iron, in which case the purity of the gold is altogether indifferent. The precipitate formed is washed upon a filter with boiling water, completely dried, then mixed with a little calcined and finely powdered borax, and the whole reduced to a thick paste with a little essence of turpentine. This paste is applied upon the glass by a pencil; it is then placed in a muffle furnace at a temperature sufficiently high to volatilize the turpentine, and vitrify the borax. The gold is then found solidly fixed upon the glass, and all that remains is to burnish it, which is done first with a polisher of blood stone, then with a burnisher of agate. The red and black glasses, the hyalite, and sometimes blue and green glass are those principally gilded.

Silvering.—The silvering is performed precisely in the same way as the gilding. The powder of silver required is procured by precipitating nitrate of silver by a bar of copper. The silver harmonizes particularly well with the white, green, and blue opaline glass.

Platinating.—Platinating is much less used than gilding and silvering, and is performed in the same way, the powder of gold, or of silver, being replaced by the double chloride of platina and ammonia well washed. The color of the platina approaches more nearly to that of steel than to that of silver.

Incrusting.—The art of incrusting in glass appears to have been invented in Bohemia, about six centuries ago; it was afterwards entirely lost, and has but recently been recovered. At present they incrust in a great deal of glass, while making it, small objects in white clay, which have, when the glass is finished, a deceptive lustre, and appearance of mat silver.

CHAPTER XIV.—*Manufacture of Looking Glasses.*

Almost all the looking glasses made in Bohemia are small and blown; there is but one establishment, that of Deffernich, belonging to MM. Abele, where they cast their mirrors, and these proprietors being of French origin, use the processes of our own country. I shall, therefore, have but little to say upon this manufacture.

The Bohemian looking glasses are of potash base, as we have seen, and have for their formula (K Ca Al) S^3; while the French glasses have soda for their base, and their composition, according to Dumas, is expressed by (N Al Ca) S^6. This difference arises from the fact that potassa being a less energetic flux than soda, it is necessary to use a much more considerable quantity, in order to produce a glass of the same fusibility, and even then the glass produced is less hard than that of soda base, which joined to the greater cheapness of this latter, has caused a preference for it, as is the case in France.

Manufacture of Blown Looking Glasses.—The blown looking glasses are made in rectangular furnaces, containing upon each shelf three circular pots, which last from three to four months, and hold about three hundred and ninety-six pounds. Each melting furnace has six flattening kilns annexed to as many annealing ovens, and arranged exactly as those of which we have spoken in the article upon the manufacture of window glass, with these differences:—1st. that they are larger; and 2d, that they place the fuel upon a lateral brick grate, separated by a small bridge from the flattening kiln, from which the flame passes into the annealing oven.

In all these are employed two firemen, and five melters at the melting furnace, and three workmen at the flattening kilns. The manipulation is the same as in the manufacture of window glass, and consists in blowing large cylinders, which are then opened in the direction of their axes, only the operation is more difficult in consequence of the size of the pieces worked. After twenty-four hours melting, the five melters unite to work the glass of one of the pots, they then rest for two hours, pass to the second pot, and so on. The working of each pot lasts about two hours, so that a complete melting lasts about forty-eight hours, and there is used in this time, in the melting and flattening furnaces, of wood dried in the air (1925.694772 cubic feet,) about 15 cords.

Manufacture of Cast Mirrors.—The cast mirrors are manufactured exactly as at St. Gobain. The furnace is square, and holds four pots having the forms of a reversed pyramid with a square base, which contain each 246.5 pounds of glass. When the melting is finished the thin brick wall opposite to each pot is destroyed, and the pots are then moved to the casting table by means of a carriage composed of curved tongs mounted upon wheels, the degree of separation of which tongs may be regulated by means of a ring sliding upon their handles. The casting table is of copper, and upon the edges are placed two rules of iron parallel to each other, and of a variable height according to the thickness to be given to the mirror; between these the glass is run. The surface of the cast mass is then flattened whilst it is still soft, by means of a hollow cast-iron roller welded to a wrought iron axle about 20.5 inches in diameter, which moves upon the iron rules, and weighs from about 650 to 1000 pounds, according to the size and thickness of the mirrors cast. The mirror and the slab which supports it are then slid into an annealing oven previously heated to dull redness, where it is left to cool very slowly.

The Polishing of Mirrors.—The mirrors, whether blown, or cast, must be polished before being silvered. This polishing requires a previous rough grinding, which is performed by rubbing one glass over the other with river sand, a quartz granulated and pulverized, or even simply pounded granite interposed; for this purpose the glasses are fixed with gypsum upon slabs of lithographic limestone, which is obtained from Nuremberg.

A water-wheel gives a backward and forward motion to the upper slabs which are allowed to turn upon themselves, and which slide over the lower slabs which are fixed; the only labor of the workman consists in giving, from time to time, a motion of rotation to the upper slabs, and stirring up the mixture of sand and water upon the lower slabs with a wooden trowel. Of course, sand more and more fine, must be used as the operation advances. A single workman can attend to two large glasses, or to four small ones. After this the polishing of the glasses is executed by rubbing them with a row of small slabs of Nuremberg limestone, either four or eight, according to the size of the glasses to be polished, and provided upon their rubbing surfaces with felt, coated with colcothar. (jeweller's rouge, red oxide of iron.)

Silvering the Mirrors.—In silvering the glasses a large slab of Nuremberg lithographic limestone is used, upon which is first spread a sheet of tin by means of a wooden roller, which is then smoothed with a hare's foot, and an excess of mercury poured upon it, which is spread with the same hare's foot until the leaf is entirely amalgamated. During this operation a part of the mercury flows off and is collected upon a table with raised edges, upon which the slab rests. The mirror to be silvered is then slid upon the edge of the lithographic stone, and finally laid flat upon the amalgum of tin which attaches itself to it. The glass is then covered with slabs of the limestone, (wrapped in muslin, so as to avoid scratching it,) in order to free it by pressure from the greatest part of the excess of mercury. Twenty-four hours afterwards the whole is lifted up, and the glass is moved to the upper story of the shop, where it is placed upon trestles first horizontal, then gradually inclined until the mirror has a vertical position. It rests in this way for several days, and may then be exposed for sale. The entire duration of an operation of silvering lasts from two to four weeks, according to the size of the mirrors.

CHAPTER XV.—*A general statistical view of the Glass Works of Bohemia.*

The glass works of Bohemia may be divided into three distinct groups. The two first situated, the one in the north in the *Reisengebirge*, the other in the south in the *Böhmerwaldgebirge*, are employed in the manufacture of glass in general, whilst the third, situated in the west in the part of the *Böhmerwaldgebirge* belonging to Bavaria, include only manufactories of blown mirrors. In fine, there are in Bohemia one manufactory of cast mirrors, *(Deffernick,)* thirty-one manufactories of blown mirrors, of which seven make, beside, table glass, and sixty-seven glass works properly so called, of which thirteen manufacture window glass, fifteen fine table glass, or Bohemian crystal, one hyalite *(Georgenthal,)* one composition glass *(Josephthal,)* one flint glass *(Neuwelt,)* and five in which they mould under pressure.

There exists besides in the north of Bohemia, principally near Hayden, a very great number of small establishments which are employed either in the cutting and finishing of glass which they buy in a rough state at the manufactories, or more frequently in the manufacture of false pearls, which are made of small hollow bulbs of glass into which a solution of the scales of the bleak *(lenciscus)* in ether has been introduced. These different glass works afford subsistence to more than 30,000 persons.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Contributions towards a History of Inventions, or Memoranda collected chiefly from obsolete Authors.

The following observations may be interesting to modern mechanics, not only by showing what has been done, or proposed, but as affording useful hints. The selections may not always appear judicious, yet when the subject is of little moment, it is sometimes associated with writers, customs, or historical data, &c., worthy of note; on the whole there may, I think, be drawn from them "both pleasing and profitable uses by those that have either witte, or will, to applie them."

There are abundant proofs of a spirit of active inquiry into the useful arts in the latter part of the fifteenth, and throughout the sixteenth and seventeenth centuries. A few scientific men began the study of mechanical philosophy, and artizans became alert to find out new inventions. In the reign of Elizabeth, English mechanics were repeatedly bringing forth novel projects, and soliciting exclusive privileges. Our information respecting the nature of the devices, is, however, exceedingly meagre; no doubt many were worthless, yet nothing is more certain than that during the administration of Elizabeth and her immediate successor, there were men in possession of the most valuable ideas, the maturity of which has since gone far to renovate society; but inventors, or projectors, as they were called, were considered little better than maniacs—they were staple butts for wits to expend their shafts on. Had any one European government of that epoch devoted a small portion of the wealth, lavished on court parasites, to the development of useful mechanism, the country might have been at this day in advance of all others.

In 1593, Hugh Platte, an English gentleman of education, and keenly alive to mechanical improvements, issued "An apologie for certain new inventions." Their *effects* only were described, but he was ready to exhibit the machines, and put them in operation upon receiving, or on having secured to him, a reasonable remuneration. Certificates, or recommendations, from competent persons accompanied the announcement, but all was in vain. Platte experienced the same species of neglect as his predecessors and successors did, and of which he justly complains.

In the following year he published a collection of various devices, not those referred to in his apology, but chiefly such as he had gathered from books, or from friends. Several he tested by experiments; his book is obviously similar to previous publications of the kind, resembling somewhat the pamphlets of Porta, Besson, Bates, Decaus, and Worcester. It is entitled "*The Jewell House of Art and Nature, conteining diverse rare and profitable inventions, together with sundry newe experimentes in the art of Husbandry, Distillation, and Moulding: faithfully and familiarly set downe according to the author's owne experience. By* Hugh Platte, of Lincolnes Inn, gentleman. London: printed by Peter Short, 1594," (upwards of sixty years before Worcester's Century appeared.)*

The work of 1594, is a small quarto, and consists of three parts, or rather three volumes, for each has a separate title-page; the first contains 96 pages, the second 60, and the third 76: the whole is dedicated to the unfortunate Earl of Essex, to whom Platte remarks that he had long buried (mentally) the contents of the book, but reflecting that all private labor should tend to the public good, he concluded to offer these labors of *his youth* to his country, under the protection of Essex, "because in these daies of deepest censure each author of nouvelties, be they never so really and roially performed, is every way in danger, both of sharp and sodaine reprehension, not only of the base and vulgar sorte of people that measure other men's conceipts by their owne, but of those also that have had some better education, and been brought up even in the same schooles, yea, and under the same tutors with them." He alludes to the jeers of his associates in the law.

In the preface he complains of opposition from both ignorant and informed, but, like Savery, he administers some smart fillips. An extract or two will convey a better idea of the difficulties inventors then lay under, between two and three centuries ago, than any thing else.—"Because in my late apologie of certeine newe inventions I made a condecionall promise of some farther discoverie in arteficiall concepts than either my health, or leisure, would then permit; I am now resolved, notwithstanding the unkind acceptation of my first fruits, which then I feared and hath since falne out, is a sufficient release in law, of the condition, to make the same in some sort absolute, though not altogether according to the fulnesse of my first purpose, and I am the rather persuaded hereunto that I might both second my first labors with a fresh supplie of credit, as also for the better satisfaction, or rather suppression of all those *professed enemies of ingenious devises*, who, notwithstanding those manifold and inavoidable testimonies produced in the same apologie . . . doe without all wit, reason, or humanitie, not only make a question of the possibility of them, but have both *utterlie condemned them* in their own conceipts, and pronounced their fatal sentence upon them in the midst of *much sacke and sugar.*"

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* In 1653, an edition was published in which the author is called "*Sir* Hugh Plat, of Lincoln's Inn, knight."

Inventors offered wagers to accomplish all they proposed:—"Yet herein I must of necessitie allowe of their grave wisdoms, who, being not able to rule their rash and riotous toungs, have alwaies shewed so great a government ovre their enchanting purses, as that at all times when the question came to be tried by any round wager (which hath been oftentimes offered them in my behalf, and shal stil be maintained in despight of their ignorance,) they have presentlie shifted themselves by an apostrophe to a newe matter, as if they had spoken unawares they knew not what." . . . . . "But to leave these leaden daggers with their golden sheathes to the cutlers' shops, where they would make a goodly shewe if they were hung up in a Michaelmas terme!"

He suggests that governments should patronize inventors:—"Were it the good will and pleasure of her most sacred majestie to propound some liberall stipende for all such of her ingenious subjects as shall bring forth any profitable or rare particular for the general good of his prince and country, I would hope to see a newe revolution of the first golden age."

He refers to Latin, French, and Italian authors who had written on "rare and profitable inventions;" and mentions Albert Magnus, Alexis of Piedmont, Cardan, Mizaldus, Baptist Porta, Firovanto, and Wickerus. He apologizes "for introducing his volume in these florishing, though *unrewarded daies* of skil and knowledge, when *so many editions* of excellent authors concerning the *same subjects* had been published. After observing that most of the foreign authors were untranslated—that much of his own treatise was new and fitted to the understandings of "rustical people, and plain clouted shooes." . . . . . He asks why he should not give his country the fruits of his reading, study, and experiments. He anticipates from well disposed readers a friendly plaudit, which was the most he desired, or a free pardon for his temerity, being the least he could deserve.

The *first* volume, or part, contains one hundred and three experiments, Worcester's Century consisted of just one hundred propositions—hence its name. Platte's book throws light on many things in Worcester's.

The first device relates to keeping fruits and flowers fresh after being gathered; this is the longest article in the book. At the close he tells us he has written a "conceyted booke of gardening," containing many new improvements, but declines publishing till he ascertains what reception his present book meets with; and intimates that if it should be no more favorably noticed than his "Apologie,' (which he compares to the raven sent from the ark,) he will not give it to the public. "It is," he remarks, "all readie for the presse, and does only attende to see if Noah's pigeon (the present work,) will returne with an olive branch, seeing his raven hath as yet brought nothing with her."

2. *A Perspective Ring that will discover all the cards that are neare him that weareth it on his finger.*—This was an invention of some French gambler; it consisted of a hemispherical crystal, or rather of a minute convex mirror, set in place of a gem. The wearer by stretching out his arm, (as if involuntarily,) "leaning nowe and then on his elbow," and other movements, so as to bring the ring into a proper position, could read in it the hands of every player. Platte says the secret was little known in England, because native workmen could not set and "foyle the stone so artificially as it ought to bee." He published the cheat to guard young men from card playing, by showing them one of the "many sleights and cousonages dailie practised in gaming and dicing houses."

4. *To Preserve Meat Fresh.*—The fowl, or flesh, was to be parboiled in a strong brine, after which it would keep fresh for three or four weeks in the hottest weather. He recommends it to seamen who "are forced sometimes to vittaile themselves in climates where no flesh will last sweet four and twentie hours." He mentions a custom of parboiling fowls, &c., in brine, and then placing them in pots filled up with lard, and so preserved for a considerable time.

5. *To Keep Water Fresh at Sea.*— By adding a little "oyle of sulphur;" some preferred oil of vitriol. He mentions distilling salt water as then practiced. Sir Francis Drake, with whom he was familiar, it seems tried various modes of keeping water fresh; "and Captain Plat,* in whom Sir Francis Drake, for his good parts, did alwaies repose great trust," used to hang thick pieces of sheet lead in the centre of each cask; upon those the slimy matter collected, and was removed by drawing up the lead through the bung hole.

6. *A Merchant's Compasse.*—This was a mere indicator of wind; the rod of a vane was continued into a bed chamber, or other room, when an index and card on the ceiling enabled a merchant to ascertain at any time of the night the direction of the wind, and thus calculate the arrival of his ships. The device is inserted in several old collections. Schottus gives a figure of it in his Hydraulico Pneumatica, &c., page 321.

8. *On Secret Writing.*—One side of a letter was to be occupied

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* A relative of the author.

with ordinary matters and written with common ink; on the other side confidential subjects were to be written with *milk.* By holding the sheet to the fire the writing became legible. Gall water and a solution of copperas, were also used as invisible inks, and cambric *handkerchiefs,* as substitutes for paper, a lady's ruff, or other white parts of female apparel: another mode was to cut openings through any part of two sheets of paper; one was kept by the writer, and the other by the person addressed. When a secret was to be communicated, the writer laid his perforated sheet over a blank one, and expressed his ideas on the open spaces only, then removing the perforated sheet he filled up the spaces between the openings with ordinary matters, or with words at random. On receiving the letter the person for whom it was designed laid over it his "key sheet," and read the important matter at once. Platte alludes to, but does not describe the mode by which the Romans and Greeks sent orders to their generals, viz., by folding the paper round a short staff, or baton, in a spiral direction, and then writing their directions upon it. On unfolding the sheet the whole appeared in utter confusion.

10. *To Harden Leather, and make it more durable for Pump Suckers.*—This device we have often met with; such early notices indicate an extensive use of common pumps. The leather was to be soaked in water in which iron filings had long lain, or in the water of grindstone troughs. "This," he observes, "has been found of good use by one of the pumpe-makers of our time." He thinks the reader may pump out of it other and better uses.

11. *A Conceipted Chafing Dish, to keepe meat hote upon the table without coals.*—A double dish with a cavity for an iron heater; this seems to have been an old device, and to have given rise to several others: of these Platte mentions "warming pinnes, or froes, which being put into thin cases, and those cases wrapped in linnen baggs, doe serve to heat bedds, and to cast one into a kindly sweat. The like device is used by others in conveying such iron pinns into hollow boxes of wood, first lined inwardly with metal, either to laye under their feete when they write, or studie, in cold weather, or in their coches to keep their feet warm."

12. *How to Roaste Meat more speedily.*—Here we have the portable, or *Dutch oven* of our kitchens. It was not an English device; this its name indicates, and Platte confirms. The particular improvement which gave rise to its present appellation is uncertain. It seems to have been made subsequent to the sixteenth century. This oven, like most of our culinary and kitchen apparatus, is not of modern origin—it is of classical antiquity. The *clybanus* of the ancients, by whom it was made of pottery, iron, and bronze. The *curfew* in its general form and dimensions, so much resembled the clybanus that some antiquarians have deemed both to be one device.

The Dutch oven was made of earthenware and sheet-iron in Platte's time; whether it was first made of tin plate by British workmen, and at his suggestion is doubtful. He describes it as made square, concave, or cylindrical, and either made of tin plates, or of wood, and lined with them, "for the reflexion of the heate that is gathered within will make great expedition" in the cooking. At each side was to be a slit "to let in the spitte." "I have heard of the like devise heretofore executed by an outlandish potter, in burnte clay, for the which he had his privilege, [a patent] but his devise wanted a cover; it was exceeding heavie, very apt to be broken, and not so strong in reflexion as this metalline devise, especiallie if it be kept clean and bright."

14. *How to turne five Spittes at once by one hande, whereby also much fier is saved.*—Four spits, or prongs, arranged round and united to a central one, to which the crank was attached: in old kitchens when several joints were roasted at once, they were placed one above another on separate spits, hence fire grates of great depth were required. The device obviated this, as well as the corresponding number of turnspits (boys.) The source whence Platte drew the improvement, was "Pope Pius the V, his Kitchen." Bartholomew Scappi, cook to the Pope, wrote a work on cookery which he named the *Kitchen.*

17. *To make a Pistol carry a ball 'point-blank eight skore feet.'*—The barrel was to be *grooved*, like the modern rifle, with eight channels, the bullet "a thought bigger than the bore," and rammed home with "the skowering stick."

20. *To enable any person to walk on precipices, &c., without danger of falling.*—He is to wear a pair of spectacles, the lenses of which are such as enable him to see things close to him only, "for it is the steepnesse that bringeth fear, and overturneth the brain." A person who played some antics on St. Paul's steeple, "did help himself in his desperate attempt," with such spectacles.

21. *A round ball of copper, or laton, that will blowe the fire verie stronglie, &c.*—The eolipile, or philosophical bellows. (The cut resembles the one I have given in my account of Hydraulic Machines, figure 286, on page 569.)

22. *Wooden Bridges* without fastening any timber work in the water.

27. *To handle hot iron, &c.*—Dipping the hand in glue, and then sprinkling horn ashes over it:—glue and alum, &c. (From Cardan and Wickerus.)

29. *To make a candle give as much light as several.*—A double glass globe, the light placed in the inner one, and the outer filled with spirit of wine, or distilled water, like those in chemists' windows. A friend of Platte was shown the device in Venice. Polished reflectors are also suggested. Jewellers at the time used globes filled with water to engrave by at night. A lamp, or candle, being placed behind each. Platte, in his article, speaks of *magic cups*—"drinking bolles with false bottoms, wherein sacke, or claret, wine may be conveyed with fair water onlie in the uppermost part of the cup, whereby a plain meaning man may easilie be deceyved." (See Hydraulics, page 520.)

34. *Ink Powders.*—Copperas, galls, gum arabic, &c., calcined.

37. *Transferring drawings, oiled paper, &c.*—The camera obscura for taking landscapes. The latter he does not explain, because of "the weake faith that reigneth in the world at this time." He pro-

bably took it from Porta's Natural Magic. He here mentions an inferior window glass then made in England.

41. *Speaking by Signs* "to be practiced by such as doo naturally lacke their speech."—Substantially the same as now practised in deaf and dumb institutions. Signs for the letters of the alphabet were to be devised, "but the vowels for the more readinesse thus.—A, upon the tip of your thumb on the left hand; E, upon the tip of your fore finger on the same hand, and so of the rest, so as when you lay the index, or forefinger of your right hand on the tip of the thumb on the left hand; the partie may note the same for an A." He had seen a lady and gentleman converse in this way in a company.

48. *Candles and Lamps.*—The price of tallow was high at the time Platte wrought, hence he advises the poor to make candles by dipping wick made of oakum in rosin, and to use them in the chimney place. He mentions floating lights for bed-rooms, and recommends lamps as far preferable for all purposes to candles. One special advantage was that rats and mice could not convey them into their nests, and set fire to the mats, as they often did with candles!

91. *Oiled Paper in windows in the sixteenth century.*—Thin parchment to be stretched and oiled, by which its translucency was increased. This he recommends in place of oiled paper, because it would not, like the latter, be destroyed by stormy weather; and he thinks it might be used instead of glass in such rooms as are "subject to *overseers,*—i. e. to persons peeping through the windows. Landscapes might be painted on it "to make a pretty shewe in your windowes."

99. *Projection.*—In this article he exposes the tricks by which itinerant jugglers, under the name of alchemists, deluded the unwary. He mentions a German artist over-reaching some young and rich merchants in a very clever manner. As they were on the *qui vive,* he lulled their suspicions completely by proposing that they should make the experiment, and find any thing while he would touch nothing. They, therefore, provided a crucible, coals and the quicksilver, (to be turned into gold.) The fire was kindled, one of them played the crucible under the nose of a bellows, as the juggler directed, another put in the mercury. When the contents were warmed, one of them was directed to give some gentle puffs with the bellows, as if to drive off the scoriæ, or oxide, from the surface of the metal. Then the cheat handed a small paper containing only a *single grain* of the magic powder which was to work the change. In half an hour the crucible was removed, its contents allowed to cool, and an ounce of pure gold was found in the bottom, being the weight of the quicksilver put in!

In this instance the cheat had previously conveyed the gold disguised as an impalpable power, into the *nozzle of the bellows!* The mercury in the process was evaporated, and hence the result. Platte advises every one "besotted with this art," to look out for *false bottoms in crucibles, hollow iron rods,* by which the varlets stirred the metal, *fluxes* in the form of powders, and false backs to chimneys, or such as had a loose brick closely jointed, that might be removed by a confederate in the next room, and who, on a signal, ["as a hemme(!) or such like watchworde,"] given by the cheat while diverting the attention of the novice with a walk across the room, "and with the volubilitie of toung," may remove and convey some gold, or silver, into the melting pot!

51. *Heating by Hot Water—To Dry Gunpowder.*—Double vessels of lead, pewter, brass, or copper. The powder to be placed in the upper one, and the lower kept supplied with *hot water.*

50. *Cement for broken Glass.*—One part of virgin wax, and two of mastic, or fish glew beat till it becomes clear, dissolved in alcohol. This was used by a Dutch jeweller in cementing two of the queen's crystal cups that were broken; others used isinglass dissolved in Rhenish wine.

92. A *strong Mortar* for building, by mixing waste soap ashes with loam and sand, with a little lime. Some builders used it without lime.

98. *The art of Memory.*—Much the same as now taught. It was taught "by Master Dickson, the Scot, of late yeres in England."

101. A *Portable Wagon* moved by men within it for the use of soldiers. Nothing particular.

102. *A delicate Stove to sweat in.*—The portable vapor bath of modern days. Sweet herbs were placed in a caldron, and the vapor conveyed by a leaden tube into the bathing tub, where it issued through openings in a false bottom.

103. *Refining Sugar.*—Except the vacuum pan, precisely as now practiced. The white of eggs to clarify the syrup. *Clay* put on the moulds, &c., "tempered like pappe with water," &c.

Tempering Tools.—In the SECOND PART, which treats of husbandry, he speaks of the value of salt in improving lands, and observes "some kinds of salt doe so harden yron, and doe give such temper to the edges of weapons, as that one may cut yron with them as if it were a piece of wood."

Boring the Earth.—To find marl by which to enrich the soil, he says, "I think it necessarie that everie man shoulde have a long augur, or percer, with several large bitts which he may put on and take off at pleasure, and with these he may search at what depth he will, alwaies marking what several veins of earth he fyndeth in the bitt of the augur."

The THIRD PART relates to distillation. He mentions siphons under the name of "crooked pipes," but there is nothing particular worth extracting, *unless* it were processes for making ypocras, and other old drinks!

Platte has none of those ridiculous recipes which disgrace old works, such, for example, as Cardan has given; one of which was to distil an illuminating liquid from the tails of glow worms! The whole is of a useful and practical character. In the part relating to moulding and casting there is nothing particular; flasks and moulds of plaster of paris, sulphur, and wax are mentioned.

The author winds up his book by "an offer of certain newe inventions which he will be readie to disclose upon reasonable considerations, to such as shall be willing to entertain them, or to procure some privilege for them. They are eight in number, but like Worcester's, not fully described."

1. "*A newe kind of Fire.*"—He means a new fuel; from the cut representing it, and his description, it was what has frequently been since proposed, viz., a mixture of fine, or refuse, coal and clay worked up into balls of two or three inches in diameter. He says nothing of the materials, as a matter of course, but confines his remarks to the advantages of adopting it. It was "*cheaper* than sea-cole, sweeter in burning, and more regular shaped, being made in the form of balles." It was more *durable*; gave out *no smoke;* will employ thousands of poor persons to make it; will rather promote than hinder the *coal trade;* the materials abundant; will preserve timber for ships by superseding the use of wood for fuel; will reduce the price of fire wood and charcoal; and lastly, if introduced, ten per cent. of the profit may be given to the poor, and to maimed soldiers, &c.

2. "*A vessell of wood to brew, or boile, in.*"—He means the old wooden boiler with a cylindrical fire place of sheet iron, or copper, in the middle. If so he was not the inventor, since it was described by Gesner forty or fifty years before, and is found figured in most works on chemistry of the sixteenth century.* It might, however, have been little known in England, or he may have devised a modification of it; of its value he appeals to the proofs in his "Apologie, published Anno, 1593; and if there bee anie person that, notwithstanding my testimonies therein produced, either perversely holds the same to bee impossible, or maliciouslie and slanderouslie reproove the invention of untruth; let him wage such a competent sum of monie as may counturaile (compensate) the discoverie of the secrets, and the author will make a public shewe thereof." He named it an *artificial Salamander.* It was cheaper than copper vessels—one would last twenty years—would save half the fuel usually consumed with others, and could easily be repaired by their owners.

3. "*A boulting hutch.*"—A portable grist-mill turned by hand. A figure of this is given, but the interior is not exposed. It has six good qualities: its price moderate—it avoideth waste of meal and flour—saves bolters, which are costly—prevents uncleanliness in bolting. The objections made against it by the London bakers were false and malicious. It is durable, and will not be chargeable for repairs.

4. "*A portable pumpe.*"—A figure of this is also given, but the construction is wholly concealed. It is a forcing pump, and a man works it without a lever. It is recommended as cheaper than any pump the author is acquainted with—light and easily transported from place to place by one man—will deliver from four to six tons of water an hour; placed in a tub it can be used for draining fens, or forcing the Thames water into kitchens; and it is recommended to seamen as a good ship pump. There is one feature in the description which renders the rest very doubtful. He says a man may work it five or six hours without intermission, and cannot possibly be

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* I have seen it figured in a German work on Distillation, published in 1527.

wearied! His remarks corroborate the opinion that forcing pumps were then little known in England. [See Ewbank's Hydraulics, pages 295, 296.]

5. *A new kind of bread* made in the form of wafers, and very cheap, with a *screw* press worked by a *pinion and cog-wheel*, for stamping, or forming, the wafers.

6. A mode of *banking earth* against the sea, or repairing breaches in canals, &c., with "artificial stones."

7. *Water-proof garments*, light and proof against a continual rain, probably an application of a solution of india rubber, or other gum. Caoutchouc was, however, then but little known, and according to some authors not at all.

8. "*A newe conceit in Peter Works.*"—A device by which half the fuel expended in manufacturing salt-petre could be saved. He offered it to "the peter men" if they would give him one-third of the amount it saved them, but it seems without effect; perhaps an application of his wooden boiler.

The foregoing articles are the whole that appeared to have sufficient interest to be worth noticing. T. E.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on the Type-Setting Machine.

Sir,—I perceive in the April number of your Journal, (vol. vii, 3d series, p. 284,) an article giving a description of a type-setting machine, copied from the *Transactions of the Society of Arts*, which seems to me to speak more favorably of it than it deserves.

The last paragraph reads thus:—"When in full work, as many as 8000 letters, etc., have been set up by this machine in an hour; whereas, by the ordinary method, a good compositor can, on the average, set up about 1700 letters in the same time; the wages paid in each case being nearly the same amount."

From reading the foregoing it would seem that the utmost power of the machine was the setting of 8000 letters in an hour; and this number I find, by actual measurement, to be equivalent to 3670 m's, and 1700 (the amount set by a compositor in an hour,) to 780 m's. 3670 m's are 550 more than four compositors could set in the same time, but the distributing and correcting of the types are allowed for in calculating the amount set by a compositor, which is evidently not done on the part of the machine. It is estimated that one hand will distribute about 4000 m's in the same time that he sets 1000, and if so the machine will require one hand to distribute. Each letter must, in the meantime, be set out of the case, and put in the place appropriated to it in the machine, which will require at least three hands, making due calculation for their not having to stop to read copy, these, with the two hands required to work at the machine, make six, as the number required to keep the machine in action. Six hands working at case will set 4680 m's in an hour, which is a little over 1000 more than the machine will do in the same time.

The machine besides setting 1000 m's fewer in an hour than six compositors, will cost a considerable sum, and the price of the apparatus, its wear, and its great liability to get out of order, are not taken into the account, which certainly should have been done.

Cincinnati, October, 1844. T. L.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Screens for Carding Engines.

By page 102 of the February number of the Journal of the Franklin Institute, I observe that letters patent of the United States, have issued to Joseph Munroe, of Hampden county, Massachusetts, for *"the application to carding machines of a screen which will permit the dirt, motes, &c., to escape without the cotton and wool, as described."*

The screen referred to, is, beyond doubt, a very useful appendage to a carding engine, and though it may have been original with Mr. Munroe, it may not be uninteresting to the public to know, that this identical contrivance has been in use at the Rockland Cotton Mills, on the Brandywine, near Wilmington, Delaware, ever since the year 1828, and, though it was not original with us, we can bear testimony to its great utility.

Rockland, Delaware. W. WALLACE YOUNG.

Process for Preparing the Purple Powder of Cassius.

M. Figuier gives the following as a certain process for preparing the above named compound:—dissolve 300 grains of gold in five times their weight of aqua regia, prepared from four parts of hydrochloric acid, and one part of nitric acid; evaporate the solution almost to dryness; this evaporation is requisite to get rid of the acid. The chloride of gold being redissolved in water and filtered, the solution is to be diluted till it measures 26 ounces; fragments of granulated tin are then to be put into it, which becomes turbid and brown in a few minutes; its tint gradually becomes deeper, and at the end of a quarter of an hour it assumes a fine purple color, the precipitate is deposited, and it remains only to collect it on a filter.

It sometimes happens, and especially when large quantities are operated on, that the precipitate does not separate, but remains in the liquid, to which it gives a deep purple color; in this case it is merely requisite to heat the liquid slightly, and to add a little common salt; the product then immediately separates.

When the liquid holding the purple powder in suspension is decanted to separate the excess of metallic tin, care must be taken that no particles of tin, which remain at the bottom of the vessel in the state of a black powder, are poured off with it; it is proper to allow the liquor to settle for some time, and afterwards to decant it; this operation should be repeated three or four times.—*Ann. de Ch. et de Phys.*, Juillet, 1844. Lond. Edin. and Dublin Phil. Mag.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE

State of Pennsylvania

AND

AMERICAN REPERTORY.

MAY, 1845.

CIVIL ENGINEERING.

The Falling of a Mill at Oldham, having cast-iron girders, and brick arched floors.

The inquest on the bodies of the twenty persons (12 males and 8 females,) killed by the fall of the mill of Messrs. Samuel Radcliffe & Sons, at Lower House, Oldham, on Thursday, October 31,—which was commenced before Mr. John Molesworth, (deputy coroner for Mr. Dearden,) and a respectable jury, at the Black Swan, Greenacres Moor, on Saturday, November 2, and continued by adjournment on Monday, November 4,—was again resumed and concluded on Wednesday, November 6; the adjournment to that day having been made solely to enable Mr. Wm. Fairbairn, M. Inst. C. E., and Mr. David Bellhouse, both of Manchester, to prepare an elaborate report as to the cause, or causes, of the fall of this fire-proof mill.

On the assembling of the jury, on Monday, Mr. Fairbairn presented to the coroner the joint report of himself and Mr. Bellhouse; and, in doing so, said—"The object which Mr. Bellhouse and myself had, in drawing out this report, was, in the first instance, to determine the true cause of the accident, and also, at the same time, to lay before the jury such facts as will enable them to come to a correct verdict. We have probably gone further into this inquiry than is usual on such occasions; but, if the report be considered too long, it may be curtailed—and with your permission, sir, I will read the report, as I may have observations to make as I go along.—The Rev. T. S. Mills: You have entered into all the facts bearing on the defects in the structure? Mr. Fairbairn: Our object has been two-fold; first to inquire into the true cause of the accident; and next, to set the public right with regard to the construction of fire-proof fabrics in future."—[Mr. Fairbairn exhibited the plan of one floor of the mill, as to its bays, principal and cross beams, and arches, in order to aid in his explanations; and for the same purpose we have given below a copy of the diagram embodied in the joint report of Messrs. Fairbairn and Bellhouse.]

Mr. Fairbairn then proceeded to read the report as follows, adding explanations as he went on, to the following effect:—

"In consequence of a unanimous expression of feeling on the part of the coroner's jury, that a full and satisfactory inquiry should be made into the causes which led to the death of Joseph Tweedale, and others, at Messrs. Radcliffe's cotton mill, Oldham, on Thursday last:—we, the undersigned, have carefully examined the building, and, having noted every particular relative to the walls, foundations, iron beams, columns, and their fractures, are of opinion that the accident has arisen from one or two causes, namely, from the falling of one of the arches in the first instance, or, what is more probable, from the breaking of one of the large beams supporting the transverse and longitudinal arches at the extreme gable of the mill.

"From the evidence already adduced, it appears that one of the arches in the top room (the fourth from the old mill) was observed to sink some days previously to the accident which subsequently occurred; this arch, which had sunk about four inches, was considered unsafe, and the necessary preparations for refixing the centres were immediately taken for its renewal. During the rebuilding of the arch (of which about one-third was completed, the middle being removed, and the other remaining,) the building at this critical period gave way, and, as stated by one of the witnesses, the beam broke short by the column, and the whole came down with a crash. Now in this view of the case, (and assuming the evidence to be correct,) it is obvious, the beam must have broken from the lateral strain of the arches, and not from the weight acting vertically (as assumed) upon the beams which remained. In confirmation of this opinion, it will be observed, that the middle beams were unprotected from the lateral thrust, unless we except an imperfect wooden stay, which, from its soft and fibrous nature, would easily split, or crush, by the force of the edge of a flanch of only one inch thick pressing upon it."

In order to explain this more clearly, it may be necessary to refer to the plan a little. This [marked bay 3 in the plan below] is the arch where the accident is said to have commenced. The north third of the arch had been taken out and renewed; the middle third was taken out altogether when the building fell; and the south third was the old arch, as it had sunk. The middle beam [that between bays 2 and 3, marked *b*, and thirteen feet ten inches in length,] broke off at the collar [at the north end.] Two square pieces of wood, 4½ inch scantling, were put across at these points only [indicating them,] bearing upon the lower flanch of the beam; consequently, if any lateral thrust took place from the adjoining arch, or arches, [marked 2 and 4 on the plan,] its tendency would be either to split the wood, or to crush its fibres, and thus to cause the beam to break. That is one way of accounting for it. I am, however, of the opinion myself, and Mr. Bellhouse concurs with me—that this was not the cause here, but another, which will presently come before you:—

"Hence it follows that the thrust of two wide and flat arches would be quite sufficient to fracture the beam, and thus loosen, or destroy, the abutments on each side. The beam being ruptured, it is easy to conceive the result which must inevitably follow such an event. From the breakage of this beam, we may infer a serious and extensive accident; but to our minds, it does not sufficiently clear up the full amount of injury sustained; nor does it account for the immense crash and total destruction of the building, which ultimately took place."

I believe that the whole building came down almost instantaneously. If I am rightly informed, both the side walls and the gable end fell outwards.—The foreman: Not outwards, but inwards: the walls came principally inwards, like a funnel.—Mr. Fairbairn: But I am strongly inclined to think that the walls would be crushed outwards.—A juror: There is evidence to show that the walls first fell outwards; and, on the south side, a stable and several pigsties, at some distance from the building, were knocked down.—Mr. Fairbairn: I did not hear the evidence; but I made inquiries at the place; and I saw, that, on the side next the engine room, [the north] the walls had evidently, in falling, struck the side of that building, because there were indentations on the bricks. On the other [south] side of the building, again, at a distance of not less than six yards—[several jurors: Oh! considerably more,] some buildings were destroyed by the falling walls; and I was also informed that immense quantities of material had fallen outwards at the gable end. [Indeed, it was here that Whitehead was killed by the materials falling outwards towards the detached chimney at the north-east corner of the building.]—The coroner: Do you not think that the beams pulling the walls inwards would tend to make a collapse? Mr. Fairbairn: if the pillars had given way first it would; but, if the pillars remained, the walls would go outwards.—The coroner: Did you read the evidence of Mills, the beer-seller, who saw the fall from his house? He says,—"On Thursday last I was at my house, facing Lower House Mill. I saw the [north] side next the chimney begin to fall. When the roof had fallen two stories, it made a stop for a second or two. The outer walls then flew in, and it all came to the ground."—A juror: That is, the upper stories fell outwards, and then, the walls breaking, the lower portion went inwards.—Mr. Alexander Taylor, a juror: One of the firm, (Messrs. Radcliffe,) who has not been examined, says that the building began to fall outwards, and ultimately went in: that would be the lower part of the warehouse that went in. Mr. Fairbairn: However, it is not very material; for I do not know that it affects the principal cause of the accident at all, and it is not a question of any great moment.

"One of the middle beams, or any one single beam of the building giving way, could not, in our opinion, have made the ruins so complete; and, having reason to suspect some other cause, we were induced to institute a still more minute and searching inquiry into the strengths and proportions of other parts of the structure.

"On a careful examination of the fractured beams, and more particularly of those which stretch transversely across the building, at a distance of 15 feet from the extreme gable of the mill, we found a more convincing proof of the cause which led to this unfortunate occurrence.

These beams carry the ends of four other beams, which extend longitudinally from the gable on which they rest, as shown in the following sketch:—

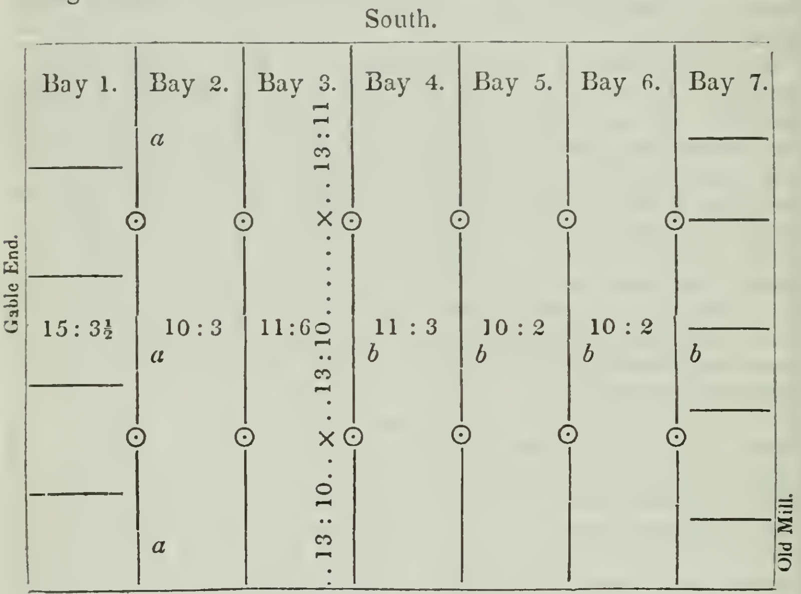

Fig. 1, Plan of Building.

[The figures indicate measurements in feet and inches.]

"From the above it will appear evident that the beams *a a a*, had to support a much greater weight than the beams *b b b*, &c.; and, consequently, they required to be made of proportionately greater strength. They were made stronger, but unfortunately, from inadvertency, *or rather from want of knowledge*, they were strengthened in the wrong place, and instead of adding the additional strength to the bottom flanch, which is always subjected to the greatest strain, it was given to the middle of the beam where it was not required."

Now, with respect to this point, if you take a beam with a single flanch at the bottom ⊥ and break it with the flanch downward, we may call the breaking weight 1000; but, if you take the same beam, and break it with the flanch upward ⊤, you will find that it will only carry a weight of 323 to break it; consequently, there is a deficiency of strength, from merely reversing the position of the same beam, in the ratio of 1000 to 323. But people totally unacquainted with this fact might suppose there was as much strength in the beam laid the one way as the other. But it is a totally different thing from timber; and cast-iron is a material so extensively used, and of so much importance in the economy of building,—and, indeed, in almost every thing connected with the industrial arts of this country,—that I have taken the liberty of pointing out to the jury the fact of the great difference in strength, in the same beam, between the one position and the other.

"It is well known, or it ought to be known, to every person giving instructions for the form and construction of iron beams, that the strength is nearly a proportional of the section of the bottom rib, or flanch; and, according to Mr. Hodgkinson's experiments, a bottom flanch of double the size will give nearly double the strength."

[Mr. Fairbairn further illustrated the form of the beams by some model drawings, not having any reference to those in Messrs. Radcliffe's mill, but which were made for a mill in Ireland,—that of Messrs. Alexander, near Lough Swilly. In reference to these drawings, he said:] These beams are not correct as to the perfect form of each; but they are as near an approximation as practice will allow; and, if the person who gave instructions in this instance for strengthening the beams, instead of putting the additional metal on the body of the beam, had attached it to the bottom rib, these beams would have been made one-half stronger, or rather more than that; but unfortunately the additional strength, in this case, has been put upon the middle of the beam. In order to explain the nature of this beam, I may observe, that, if you take a beam of any dimensions, and suppose it supported at the two ends, and then lay a weight on the middle, you cannot break that beam without pulling the particles of all the bottom part of the beam asunder, and you must break the upper flanch by compression, or crushing. There is a point called the neutral point, where the particles are neither extended nor compressed; you cannot break it without bending; and you must disturb all the particles by drawing them asunder at the bottom, and crushing them at the top. Consequently, it was found, by the very numerous, ingenious, and laborious experiments of my friend Mr. Eaton Hodgkinson, that the bottom flanch came out a proportion of about one half of the whole section of the beam; and, in the beams in question, the quantity of metal in the bottom flanch is probably not more than from a quarter to one-third of the section. The bottom flanch should be parabolas; and, in order to give it the correct form, this beam would have to be enlarged along the lower flanch, and then it would be of equal strength along the whole line of the beam. I mention this merely to show the necessity which exists for getting greater strength, by throwing the greatest portion of the metal into the lower flanch.

"These facts having been proved by direct experiment, it is important to all those concerned in the construction of fire-proof buildings, in which the lives of the public, and the property of individuals are at stake, that the form of beams and the section of greatest strength should be *perfectly and thoroughly understood;* and to those unacquainted with the subject, we would beg to refer them to Mr. Hodgkinson's paper on the strength of iron beams, in the fifth volume, second series, of the 'Memoirs of the Literary and Philosophical Society of Manchester.' * In ordinary cases, we should not have troubled the jury with these remarks; but in a case of such importance as the present, where the lives of so many persons have been sacrificed to defective knowledge and skill in the construction of buildings, wherein considerations of such importance are involved, we have considered it our duty thus publicly to direct attention to the subject, not only as regards the present but in all future cases, and respectfully to urge upon the proprietors of mills, and of other buildings containing work-people, the necessity which exists for a more secure and perfect system of building, and for a further development of the principles upon which fire proof edifices are founded. If this suggestion is properly received and acted upon, we have reason to believe, that we shall not again have occasion to investigate occurrences of so lamentable and so distressing a nature. We have already observed, that the beams *a a a*, in the preceding sketch, were strengthened, not, however, in the bottom flanch, but in the middle part of the beam, where they are thickened, and where it was absolutely of no use. Had the same quantity of metal been given to the lower flanch, these beams (the weakest in the building,†) would have carried nearly double the weight; and thus, by a proper and judicious distribution of the metal, the building as well as the lives of the people, would have been saved. These observations apply to all the other beams of the mill, which are also defective as respects their strength."

"In computing the weights upon each beam, it was found that those supporting the arches of ten feet six inches, and those of eleven feet six inches span, had to support a load (without machinery) respectively of ten and eleven tons."

That is, thus:—We compute the weight of the arch at about ten tons for the short span, and eleven tons for the other; and that is about the weight required.

"And those sustaining the ends of the longitudinal beams were acted upon with a load of thirteen and three-fourths tons."

That is, particularly the two shown here [the two outside beams *a a*,] because each of them had not only half the long arch to carry, but also half, or more than half, of the short arches on the other side.

"Now, if we take the sections of these beams, and calculate the weights necessary to break them, when laid upon the middle, it will be found that the breaking weights for the beams *a a a*, and *b b b*, &c. will be nearly the same, or about 9¾ tons. This is the breaking weight of an average quality of iron; and, allowing for the difference of metals, it could not be raised much above 10 or 10½ tons."

They must of necessity be broken with a weight of from 10 to 10½ tons. I have taken the average at 10 tons.

"The breaking weight would, therefore, be about 10 tons when the beam is loaded in the middle, and 20 tons when equally distributed over the whole surface of the projecting flanch of the beam."

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* See Journal Franklin Institute, vols. ix and x, 2nd series.

[†Mr. Fairbairn added that these beams were rather weaker in original construction than the transverse beams; and that the whole of them were certainly not such as would be considered safe.]

Now, there is a wide difference between the beam being loaded on one point in or near the middle, and being loaded along the whole beam. In the latter case, it would carry just double the weight. Consequently, you have in arches an equally distributed weight; so that a beam supporting them, and which would break with 10 tons, applied to a single point in, or near, the middle of the beam, will take 20 tons to break it, when the weight is so distributed.

"Having ascertained the bearing of the beams, we shall next compare their strength with the actual loads they were called upon to sustain; and, in making that comparison, it must be borne in mind that the two beams *a a*, next the side wall, had their loads unequally distributed, which reduced their bearing powers to 15 tons."

Now you see that on the west side of the beam *a*, it was equal to carry 10 tons; but the cross beams on the east side threw the whole weight upon the middle of the beam, and, consequently, instead of the breaking weight of the beam *a*, being 20 tons, (as it would have been, if equally distributed,) it was only 15 tons, having a distribution of the weight only on one side, and the weight on the other bearing upon one point only.

"Now the load which these beams had to support was 13¾ tons, 8½ tons being supported on a single point on one side, and 5¼ tons distributed over the surface of the opposite flanch on the other. From this it will be seen, that the actual load was to the breaking weight as the numbers 13.75 to 15, or as 1 to 1.09 being within a mere fraction, or one-tenth, of absolute destruction."

That was the very critical state in which this building was standing, as to those beams, just previously to the fall.

"Viewing the subject in this light, and taking the above calculations as data, we are no longer at a loss as to the cause of the accident. Even supposing the arches to have stood, it will appear obvious that so close an approximation of the breaking weight to the actual load was extremely unsafe, and that, under such circumstances, no precautions could have prevented the rupture of the transverse beams *a a a*, whenever they happened to be subjected to the slightest impact, or any vibrating motion tending to disturb the parts under strain, and eventually still further to lessen their already too much diminished powers of resistance."

It is clear that they must have gone some time, or other. I believe Mr. Bellhouse and I are of the same opinion, that that was the real cause of the accident, that probably from the vibratory action of the mill gearing on being set going, or from some other cause, the slightest shock in the world would fracture either of these beams *a a;* and then it is easy to conceive how the others would follow. It would not only carry the gable end down, but it would loosen the whole of these arches on the same floor, and the whole would soon come down in the mass. It would be impossible to account for the entire destruction of the whole building, unless, by some cause, the whole of the frame work of one floor came down, and one of these beams [*a a*] giving way, would account for that.—The foreman: I called the coroner's attention at the time to the evidence of Mills, taken as he lay in bed, to the effect, that after the arch fell, where he was working, the whole gable-end fell. This seems to confirm the view taken by Mr. Fairbairn.—The Coroner: "It fell bay by bay," was Mills's expression.—Mr. Fairbairn: Of course, we were not present at the time of the accident. All we can do is to reason upon it from the facts given in evidence:—

"Irrespective of the weakness of the iron beams, which we consider as the primary cause of the accident, we would beg to advert to the tie-rods, which, although sufficient in number and strength, were not judiciously placed, as respects their position, for resisting the strain of the arch, their maximum point of tension at the bottom flanch of the beam; but, that being inconvenient, they should on no account be placed higher than the soffit of the arch; and in this position, they would perforate the neutral axis, and give sufficient security to the arch, without injuring the strength of the beam. Instead, however, of approaching this point, they were on the top of the beam, and 18 inches from the bottom flanch."

Now, with respect to the tie-rods, instead of their being placed above the arch, the true position of the tie-rods should be below, forming the chord of an arc. But that, especially in low rooms, would be found exceedingly inconvenient; and, according to the experience of Mr. Bellhouse and myself, we say, that we should never go higher than the soffit of the arch.

"As respects the arches, we found the versed sine, or rise of the arch, too low; on most occasions they are 1¼ inches to the foot."

We generally prefer an inch and a half rise to every foot of span, if it can be obtained. If this be done, you will find the arch come out a very fair and correct form of arch: and it is only at the sacrifice of an inch or two in the floor, which would not be an object, compared with the security of the arches. I do not know that this has any reference to the present inquiry, except that it is a proof that the arches were too low.—Mr. Bellhouse: I think it bears directly upon it; because the arch in the top story gave way or sunk, simply from that cause,—a want of sufficient rise.—Mr. Fairbairn: I have already stated, that we had two objects in our inquiry; the one to trace out the true cause of this accident, and the other to direct public attention to these facts, in order to prevent not only the loss of property, but, above all things, the loss of life. In this latter view, every thing bearing on the construction of these buildings is important.

"As respects the arches, we found the versed sine, or rise of the arch, too low: on most occasions they are 1¼ inches to the foot. But, in order to insure perfect security, we should advise, in all future buildings of this description, that the rise be 1½ inches to every foot of span. In the arch which first gave way, the rise was only a small fraction above an inch, having a rise of only 12 inches in a span of 11 feet 6 inches."

[The Foreman suggested an alteration in the report (which is made above,) to prevent any mistake as to the supposition that the proportion of rise was the same in all the arches; and Mr. Fairbairn observed that, of course, a rise of one inch in every foot of span would be a greater rise in that arch which was only 10 feet 2 inches, than it would be in that which was 11 feet 6 inches. The correction was accordingly made, and Mr. Fairbairn resumed reading.]

"On viewing the columns, several imperfections were observed in the variable thickness of the metal; but, in other respects, the pillars were satisfactory, and presented no features of weakness indicating danger from those parts: one inch more in diameter, with the same weight of metal, would, however, have given greater security and greater strength."

On the whole it would have been better, probably, if the pillars had been a little larger.

"We cannot close this report, without adverting to the anxious solicitude of Messrs. Radcliffe, and the strong desire evinced by those gentlemen, to have every part of the structure upon the first and strongest principle; and we should imperfectly discharge our duty, if we neglected, on this occasion, to bear testimony to the superior strength of all parts of the building, except those we have just described, and on which it could not be expected they could form an opinion."

We cannot expect that gentlemen who are not acquainted with the principles of building should have an adequate knowledge of all the proportions, and as to what is necessary on such an occasion.

"In conclusion, we have great pleasure in stating, that it appears to us that no pecuniary considerations whatever were present to the minds of Messrs. Radcliffe in the due and perfect construction of these mills.

"WM. FAIRBAIRN,
"DAVID BELLHOUSE.

"Manchester, November 6th, 1844."

In addition to the above, we have procured drawings of the girders, to farther illustrate Messrs. Fairbairn and Bellhouse's report and observations.

Fig. 3.

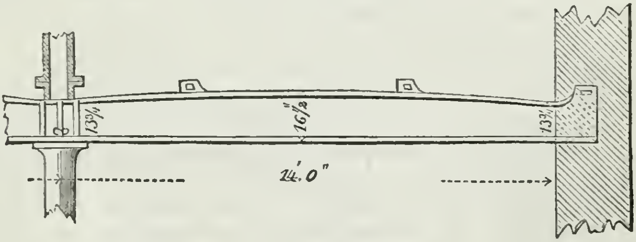


Fig. 4.

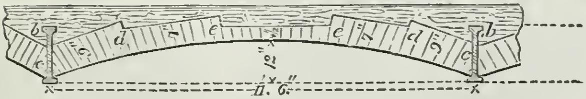


Fig. 2.

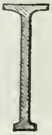


Fig. 2, section of beam supporting cross beams at the end of the mill. Depth in the middle, 16½ inches; depth at the end, 13¾ inches; bottom flanch, 6 inches by 1⅛ inch thick; top flanch, 3 inches by ⅞ inch thick. Fig. 3 is a rough sketch of the form of one of the wall beams, and the others being nearly the same it may be taken as a fair average of the whole.

The longitudinal beams which rested on the extreme gable were ½ inch deeper in the middle. The arch tie rods, of ⅞ inch square iron, were at the top of the beams, as represented by the holes *a a a*, (fig.3,) whereas they are generally fixed in the position as under, at *e ε*, (fig.4.)

From the above it will be easy to conceive the nature of the building, and the mode of construction in general use in these districts.—The arches, it will be observed, are composed of a brick length from *c* to *d*, ¾ brick from *d* to *e*, and half brick in the centre. The top of the arches is then filled up with a concrete of lime and ashes, on which is laid either the stone flagging or tiles, as the case may be.

The verdict of the jury was accidental death.

Lond. Civ. Eng. and Arch. Journ.

Explosion of a Locomotive Engine on the Manchester and Leeds Railway.

We have been so desirous of investigating the cause of the most unhappy event of the explosion of the *Irk* engine, that we have taken no ordinary pains to get at the facts. We have obtained a copy of the written evidence of Mr. Fairbairn, the maker of the engine, a gentleman well known in the scientific world, and much esteemed for his integrity and honour. We have also written to one of our ablest judges of a locomotive perhaps in England; and from the account of this gentleman in connexion with the evidence of Mr. Fairbairn, we are quite satisfied there was no flaw in the metal; and that the accident arose from the fastening down of the valve. Our correspondent says, the boiler was strong enough to bear 150 lbs. per inch. This gentleman shows how accidents of this kind may easily occur, and how to prevent them, which we hope will be attended to.

The jury have returned a verdict of £500 on the engine, and wanted to return a verdict of manslaughter against the Directors, which the Coroner very properly would not receive. Why, this Manchester Jury are a bonny set of fellows! A verdict of manslaughter against the absent master, because the servant, by improper conduct, blew his property up and killed himself! ! Can Manchester really boast of 12 such sages? We advise them to re-assemble and, to crown their folly, to bring in another verdict of manslaughter against the steam, that really did the mischief, and issue a warrant for its apprehension. It is really a pity men should be so silly.

Mr. Fairbairn's Evidence—I have carefully examined into the cause of the late accident on the Manchester and Leeds Railway, and as that occurrence involves considerations of the utmost importance as respects the public safety, I have been induced at the request of the

Chairman and Directors of the Company, as well as the Coroner, to investigate the subject with more than ordinary attention.

Conformable with these instructions, I visited the spot where the accident occurred, and from a cursory view of the upper part of the copper fire-box, it appeared as if an old crack or flaw had been present, and that part being the weakest would, as a matter of course, be the first to give way. A closer view of the ruptured parts, however, proved this impression to be erroneous, as by careful inspection the copper was found not only perfectly sound, but free from cracks and flaws of every description. This conclusion was fully confirmed on comparing the edges of the plate, which on one side gave indications of an old crack, with the corresponding part from which it was torn. By this comparison it was found perfectly sound throughout the whole length of the fracture and thickness of the plate; but it did not account for the discoloured appearance of the fracture on the opposite side of the plate, which, as before stated, indicated an old crack. A little reflection will, however, shortly explain this apparent discrepancy, and that particularly if we bear in mind the position of the plate, and the nature of the rupture where it first gave way, and where it was ultimately forced down like a piece of paper upon the front of the tubes. If, for example, we suppose the incumbent pressure of the steam to be greater than the resistance of the plate which forced the top off the fire-box, the result would be a forcing down of the weak part and a subsequent and rapid, if not almost instantaneous, rupture of the whole of that part, and an equally rapid turning downwards of the two others which form the rectangle of the fire-box. Now in the act of tearing, it is obvious that the steam and water would be discharged with great force upon the fire, which mixing with the gases and carbon of the furnace, would form a coloring matter sufficient to give those appearances to the fractured edge of the descending plate. From this it is evident that the present appearance of the ruptured edge of the plate is no indication of unsoundness in the material, which is fully proved by the clean and perfectly solid metal from which it was rent at the top bend of the fire-box on the opposite side.

Fig. 1

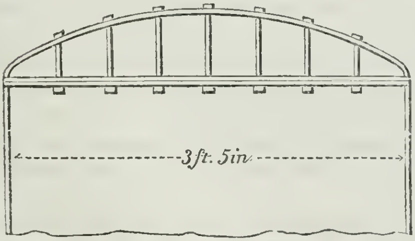
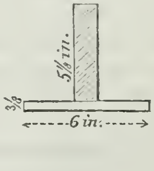


Fig. 2.



Having shown that the accident did not arise from any defect in the metal of the fire box, I would now request attention to the iron bars or stays which extend longitudinally over the metallic cover of the fire box. These stays are seven in number, and $4\frac{3}{4}$ inches deep in the middle, by $1\frac{1}{4}$ thick, and are strongly riveted with seven $\frac{3}{4}$ bolts, through the copper $\frac{3}{8}$ of an inch thick. These seven supports were fixed equidistant from each other or about 6 inches apart from centre to centre. They are also 3 feet $4\frac{3}{4}$ inches long, and rest upon the dome, as in figure 1.

From this it will be seen that the stays or bars were $\frac{3}{4}$ of an inch shorter than the length of the fire box, owing propably to the rounded corners of the dome, which did not admit of the ends of the stays fitting upon them. Now in seeking for the cause of the accident, from defects in these parts we shall find ourselves equally at a loss in accounting for results as we were in our previous disquisition on the quality of the copper which may be proved by calculations as follows:

Suppose each of the malleable iron stays, supporting the roof of the fire box, to be a series of separate beams or girders subjected to a given strain, and taking each as equal to a beam whose bearings are 3 feet 4 inches asunder, we then have a compound beam of malleable iron, and copper of the dimensions as in figure 2.

Now as the pressure is uniform and equally distributed over the whole surface, we have by the formula (after allowing for the difference of the strengths in the metals,) a force of 20.7 tons as the breaking weight, uniformly distributed over the surface. This calculation is made under the supposition as if each of the bars were subjected to a separate strain, whereas they are connected by the union of the lower flanches, thus giving a resistance in every direction to the internal pressure from above. If we, therefore, take each of their separate efforts to resist a destroying incumbent force at 20 tons, we then have $20 \times 7 = 140$ tons as the ultimatum pressure for separate beams, and supposing double strength to be gained by the union of their lower flanches of solid copper, the correct resisting force of the top of the fire box to rupture would then be 280 tons. Now 60 lbs. on the square inch would give 43.35 tons acting upon the top of the fire box; and hence would follow a pressure of 387.6 lbs. upon the square inch, which would be required before the top of the fire box and its supports could give way.

As a further proof of the strength of this part of the structure, let us again take the tensile force of copper (which of the best quality is about 23 tons to the square inch; but, taking it at 20 tons,) and it will be found that the resisting force to the rupture of one side alone will be about 310.8 tons. It is therefore obvious, that in order to force down the top of the fire box (on that side which apparently first gave way,) a force of 310 tons would be required, and an equal force of 280 to 300 tons would be necessary to break the iron stays or bars supporting the cover of the same.

Having endeavoured to establish the fact of sufficient strength in the ruptured parts of the material, and having explained the nature of the construction, so as to show that the accident could not arise from that cause, I would now respectfully direct attention to another part of the subject which appears to me to bear directly upon the question. It must appear obvious to every person conversant with the subject, that a heavy body, such as a locomotive engine, of 15 to 16 tons weight could not be projected to a height of 25 to 30 feet, without the agency of an enormous force. That power could not be maintained by the strength of the material, nor yet by its distribution, however well-arranged, in the construction. We must, therefore, look for it in some other quarter, and endeavour satisfactorily to prove, that the effects exhibited in this lamentable occurrence, do not, in any instance, disagree with the causes which produced them. In this inquiry, some curious and interesting scientific phenomena present themselves. First, to account for the instantaneous elevation of such a ponderous body as a locomotive engine, to a height of 30 feet; and, secondly, to demonstrate and explain the causes which produced that elevation.

In approaching this investigation, it would require the aid of a profound mathematician; but, that being a work of time, I must trespass upon the patience of the jury whilst I endeavour to make the most of what I have got, and to show, that the task is probably less difficult than appearances at first would indicate.

An eminent writer on mechanical philosophy states, "that forces are of themselves imperceptible, and are seen only in their effects, or what measures they effect." Now, according to the laws of gravitation, that force which accelerates the descent, and retards the ascent of a body, must be considered as a constant uniform accelerating or retarding force. Therefore, the motion of a falling body projected downwards, is uniformly accelerated, and that of a body projected upwards, is uniformly retarded; that is, the required velocities are as the times in which they are acquired by falling, and the extinguished velocities are as the times in which they are extinguished. Hence it appears, that the spaces described by a falling body, are proportional to the squares of the times, from the commencement of the fall, and the spaces described by bodies projected upwards, are as the squares of the times of the ascent. It therefore follows, that the same laws that govern the descent, also regulate the ascent of bodies; and, having these fundamental principles in mind, I apprehend we shall find less difficulty in solving the question by the simple law of projectiles. Taking, therefore, the forces of projection as equal to those of gravitation, and supposing a body such as the locomotive engine in question, 15.5 tons, falling from a height of thirty feet (which may fairly be taken as the height of the ascent,) we then have the square of 30 $= 5.473 \times 8 = 43.780$ for the velocity in feet per second, or as the force with which a heavy body falling from that height would strike the ground. Now assuming the force of impact to be as the velocity multiplied into the weight of the falling body, we again have $43.780 \times 15.5 \times 2240 = 1520041.6$ lbs., or 655.7 tons, as the momentum or measure of contact with which a body of that weight would strike the ground in its descent from a height of 30 feet. Let us now reverse the proposition, and suppose, that instead of an uniform accelerating motion produced by gravity, we have to encounter its equally uniform functions of retardation; it then follows that the same momentum of force with which the descent was terminated, would be required to raise it to the same height. It is therefore, evident, upon this hypothesis, that a projective force of 1520041.6 would be required to elevate an engine of 15½ tons to the actual height of 30 feet, in order to demolish that part of the roof removed by the explosion.

Let us now compare the forces of projection, or the powers which operated, upon the engine in its elevation to the height already named; and it will be found that 1563821 ÷ 1619.5, the area of the fire box in square inches = 939 lbs. upon the square inch. Now this pressure is more than double the strength of the fire-box, or any parts of the boilers containing the elastic force; but supposing the top to give way with 250 to 300 lbs. on the square inch, it then follows that the additional force must have been generated in the act of the explosion, by the intensely heated water and steam rushing upon the fire at a considerable higher temperature. We are all acquainted with the effects of water thrown upon a red hot fire, and the explosive nature of the volatile vapours which are thus generated by the combined action of the gases and water. The effects would be more tremendous in the case before us as the water in the boiler contained, previous to the discharge, a large proportion of heat, and the calorific effects would be a proportional to the pressure of the steam at the time when the rupture occurred.

I am not sufficiently acquainted with theoretical chemistry, to prove that this solution is correct, but I am happy to find most of my professional friends agree with me in that opinion; and, in the absence of more convincing proofs, I am disposed to consider the reasons and demonstrations already given, as the cause of the accident, which I regret to find has been attended with the loss of life.

As a further corroboration of these views, I may perhaps be permitted to advert to the prodigious power of fixed gunpowder, which is nearly 1000 times greater than that of the atmosphere, which, taken at 15 lbs., gives the enormous force of 15,000lbs. or above 6 tons to the square inch. This is very far above our computation, and looking at the position of the engine and the depth of this fire box, we may readily compare it, along with the pit below, to the breach of a mortar in throwing a shell, whence the projectile is discharged instantaneously on the firing of the powder, and the elastic force of the expended fluid. Such was nearly the case with the *Irk*, which, on the instant of the explosion, left at the bottom of the pit indelible impressions of a powerful recoil.

Viewing the circumstances of this extraordinary case in all its bearings, I am led to the conclusion that the question resolves itself into two considerations in connexion with the cause of the accident. First, that the top of the fire box was forced down upon the furnace by excessive pressure arising probably from accumulated force of the steam having no outlet through the safety valves; and secondly, by a process of inductive reasoning from the force of a body of water and vapour, at a high temperature, being discharged upon the evolving gases and glowing embers of the furnace, whereby the carburetted hydrogen, and carbonic oxide gases, were charged with their equivalents of oxygen, and explosion ensued.

The above appear to be the only principles upon which we can account for the extraordinary effects indicated in the rupture of the metallic plate in the first instance, and ultimately in the explosion and subsequent force which carried the engine from its primary position to the place where it now rests.

In closing these observations, I would respectfully intimate that the subject is one of vital importance, not only as regards the Proprietors and Directors of railways, but the public are deeply interested. and have a right to demand every security which the experience of the last 15 years can afford, either in the transit or the machinery by which that transit is effected.

It is for these reasons that I venture to recommend a searching inquiry into every circumstance connected with the present accident, and conceiving that a full and complete elucidation of this subject may not, on this occasion, be afforded, I would further suggest that a series of well conducted experiments be entered upon for the purpose of ascertaining the cause which led to the present and late accidents on the South Eastern Railway, and for determining some fixed principle of action whereby the lives of the public may be secured, and the Proprietors of railways relieved from a tax which bears with equal severity upon their reputation as well as upon the revenues of their establishments.

In the acquirement of these objects a mass of valuable information would be obtained, and our knowledge of an intricate subject greatly extended, to say nothing of the advantages which this enquiry would confer upon science. If done at all, it should be done at the expense of the different Railway Companies; and probably it could not be entrusted to better hands than the British Association for the advancement of science.

In answer to the questions of the coroner, he said he did not attribute the accident to the shortness of the longitudinal bars in the fire box. He examined the spring, balance and valves, and they appeared good. He said one of the valves was at the command of the driver, and could be screwed down by him; if he had done so, and the safety, or lock-up valve, had been down also by any unknown cause, an explosion would, as a matter of course, follow. He said the same consequence would ensue if only one of the valves had been closed, provided the steam was generating very rapidly. He heard that, for the purpose of getting up the steam very fast, the valve, at the command of the driver, had been screwed down. From what he saw of the fire box, it appeared perfectly square and sound, as well as all parts of the boiler. He looked, he said, very carefully—at first it appeared as if part of the fire box had been cracked; but on comparing the fractured parts, it was afterwards found the copper had every appearance of being sound and good metal, and of sufficient strength. Mr. F. said the *Irk* was made in January, 1841, and had been in the use of the Company from that time. The driver, he said, could not screw down the lock-up valve. The lock-up valve would have opened unless something had prevented it. His opinion was that the accident arose from excessive internal pressure, forcing down the top of the fire-box, and from the explosion of the gas as stated in the report. The corresponding piece of copper which Mr. Fairbairn had taken away with him on the morning of the explosion was then produced for the inspection of the jury. Mr. F. pointed out the part which corresponded with the blackened edge of the other part of the fire-box, and it appeared perfectly sound, without any signs of a fracture.

The following is the letter referred to in our introductory remarks. —"I have pleasure in affording you such information as it is in my power to give respecting the construction of the fire-box of the Manchester and Leeds Company's engine *Irk* which exploded the other day. The inside shell of the fire-box is made of copper three-eighths of an inch thick (the tube plate was of course thicker.) The dimensions of the horizontal section of the inside shell are 3 feet 5 inches × 3 feet 3 inches. The sides of the inside shell are well stayed to the sides of the outside (iron) shell by bolts placed, say 5½ inches apart. The roof of the inside shell is flat, and is stayed in the usual manner with strong bridging bars, seven in number, each being 5 in. deep by 1½ in. thick, and extending from back to front over the roof of the inside shell. The whole was most strongly stayed, and was of ample strength, I should say, to sustain a pressure of 150 pounds on the square inch, or more than twice the working pressure. There was no defect or flaw visible. The sketch below, may, perhaps, serve to explain to you the mode of construction, which is similar to that adopted on the Liverpool and Manchester Railway.

Fig. 1.

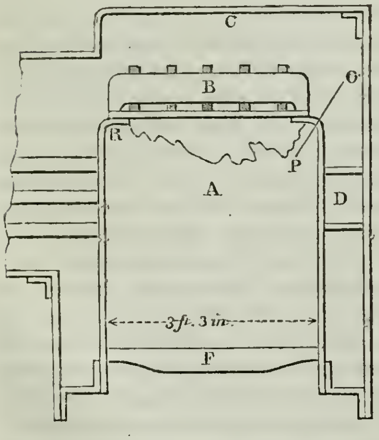
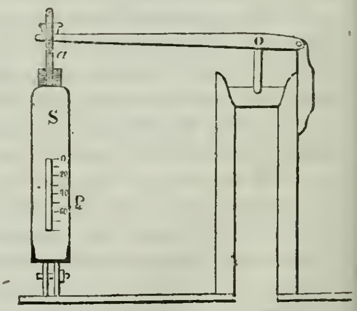


Fig. 2.



A, inner casing of fire-box; B, bridging bars; C, outer shell of casing; D, fire door; F, fire bars.

The fracture took place along the angle intersected by the line O P. The edges of the plates along that angle were as if cut clean by a pair of shears. The entire roof came down like a door turning on its hinges, as on the centre R. The sides of the inner shell were torn by the fracture into saw teeth. It was certainly a defect in construction not to make the bars B. long enough for their ends to rest upon the extreme angle at O P and R, and accordingly this angle has proved to be the weakest part; but this fact is not sufficient to account for the explosion, which, if I may hazard an opinion, is only to be explained on the assumption of an excessive pressure of steam in the boiler. Constructed as I understand the safety valves were, and as those of too many locomotive engines are, nothing is easier than to render them absolutely useless. You have only to screw the nut until the index pointer reaches the bottom of the scale, where it is stopped by coming in contact with the end of the slip in which it travels, and you make the safety valve a fixture, which no pace, short of one sufficient to break or bend the lever, can move.

The remedy which puts the control of the safety valve beyond the reach of any workman, is to put a small collar or ferrule over the screw at *a*, fig. 2, so as to prevent the index pointer P from ever reaching the bottom of the scale, screw the nut as you may. When the steam begins to blow off strong, the workmen have a strong temptation to put on extra pressure to prevent noise and waste of fuel. S represents Salter's balance. Herapath's Jour.

Description of the Great Britain Steam Ship.

Though many descriptions have been given of the Great Britain, we are induced to insert the following, as being the most clear and succinct that we have seen, and which we copy from an interesting pamphlet just published by Capt. Claxton, entitled "A Description of the Great Britain Steam Ship," &c.

The length of the keel 289 feet. Total length, 322 feet. Beam, 51 feet. Depth, 32 feet 6 inches. Feet of water when loaded, 16 feet. Displacement, 2,984 tons. Tonnage by Old Measurement, 3,443 tons. Plates of keel nearly one inch thick. Plates of Bottom varying to ¾ of an inch at extremes, and to ⅝ths generally. Topsides ½ an inch, and at the extreme aft 7-16ths. The ribs are framed of an angle iron, 6 inches by 3½ inches; ½ inch thick and 7-16ths. Distance of ribs from centre to centre, amidships, 14 inches, increasing to 21 inches at the ends.

Ten iron sleepers run through the engine rooms, gradually diminishing in number, to the fore-end of ship and under the boilers, the platform of which they support—in midships they are 3 feet 3 inches in depth, supported by angle irons in the form of inverted arches, and a short distance from each other. She has five water-tight partitions. Stows 1200 tons of coal. 1000 tons of measurement. The engines weigh 340 tons. The boilers 200 ditto, and hold 200 tons of water.

The main shaft is 23 inches in diameter in the centre, and 24 inches in the bearings; in the rough before turned, it weighed 16 tons. It has been lightened by a hole of 10 inches diameter, and bored through. A stream of cold water passes through the cranks and this hole when the engines are at work. The screw shaft is in one long and two short, or coupling, parts. The part next the engine, solid, 28 feet by 16 inches diameter. The hollow intermediate shaft 65 feet, by 2 feet 8 inches diameter; the screw part is 25 feet 6 inches, and also 16 inches diameter; the total length is 130 feet, and it weighs altogether 36 tons.

The screw is of six arms, 15 feet 6 inches in diameter, 25 feet pitch, and weighs 4 tons. The main drum is 18 feet diameter, and drives 4 chains, weighing 7 tons. The screw shaft drum is 6 feet in diameter, and the weight with the pull when working is equal to 85 tons on the bearings of the main shaft. The cylinders are four in number, 88 inches each. Stroke 6 feet. Power 1000 horses. The condensers are of wrought iron, 12 feet by eight, and 5 deep. Under the whole space of the engines, up to the top, the angle irons are doubled. The upper, main and saloon decks are of wood, the two cargo decks are of iron. The officers and seamen are all accommodated on two decks under the forecastle.

From the ship's bottom to the upper deck, runs on either side, for the whole length of the engine and boiler space, a strong iron partition forming below the coal bunkers; and above, the servants' accommodations on one side, engineers' cabins and stokers' accommodations on the other, besides 26 water-closets. She has six masts, fitted with iron rigging, adopted in consequence of its offering two-thirds less resistance than hemp,—a great point going head to wind.

The plain sails of a 52-gun frigate, that is, without bunting, royals, stay-sails and steering sails, number something short of 5000 yards of canvas, and the plain sails of the Great Britain amount to 4,943 yards. She carries four large life-boats of iron, and two boats of wood in the davits, and one large life-boat on deck; they are built according to a patent taken out by Mr. Guppy, and are capable of carrying four hundred people. Nautical Mag.

Description of Ellis's Turn-Table. By B. Rotch, Esq. V. P.

This ingenious invention obviates one of the greatest objections to the turn-table, which is, its being supported on numerous small friction-rollers under its outer edge, as well as on a central pillar. The object of these rollers is to facilitate the turning of the table when the heavy weight of an engine or carriage is upon it; but this weight is so excessive, that coming, when passing over the table unequally, first on one edge, as it enters upon it, and then on the other, as it passes from it, the table gets pressed down, first on one side, and then on the other, with such rapidity and violence of strain as to cause a great noise of successive jarring blows, and a constant derangement and damaging of the rollers.

Ellis's turn-table prevents all this, by doing away with these rollers, and allowing the outer edge of the table to rest firmly, and without rollers, on a solid support, or circular bed, made to receive it. It is also supported on a central pillar, on which the centre of the table bears firmly and steadily at the same time. When the table is left in this condition, which may be called its position of rest, the bearings are so firm that the engines and carriages roll steadily over it without noise or jar, just as if it were a part of the railway itself; but the central pillar is so arranged as to be easily acted upon by a compound lever, on the principle of the lever of a weighing machine, and the table may, in fact, be made into a weighing machine by adapting a steelyard and weights to this compound lever; and, when it is required to turn a carriage or engine on the table, it is rolled on to it while remaining firmly and steadily in its rest position, and, when the weight is placed on its centre, and has an equal bearing over the table, the table is lifted from its circular bearing all round the outer edge by the compound lever, and thrown entirely on the centre pillar, the bottom of which resting on a pivot, the whole may be turned round with the greatest ease the distance required, and the table then let firmly down again on its solid circumferential and central bearing, or to what is called its rest position.

This plan is very simple, very effective, and saves an immense amount of wear and tear in the item of turn-tables. It has already been extensively adopted. Trans. Soc. Arts.

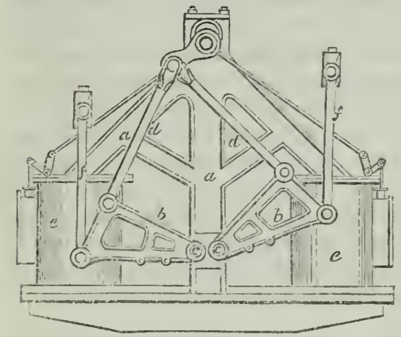
Ancient Tunnel.

According to the French papers, a new and remarkable assertion of the powers of ancient practical science has been brought to light, in the city of Marseilles, to dispute the triumphs of the present. That town is, it seems, suddenly about to be endowed with a ready-made tunnel, of larger dimensions and greater extent than Mr. Brunel's extraordinary performance below the Thames. There has long been known to exist a subterranean passage, which tradition reported to lead from the parish of St. Victor to an issue beneath a tower in the fort St. Nicholas,—passing, therefore, at the mouth of the port, under the deep sea, where float the line-of-battle ships! For many years, the termini have been encumbered with rubbish; and no one had ventured to verify the tradition by attempting the perilous passage. This daring, and even rash, enterprise has been, however, successfully achieved by M. Joyland, Engineer of Roads and Bridges, and M. Matayras, architect. Repairing, with some friends, to the ancient abbey of St. Victor, they penetrated, by a long flight of steps, to the bottom of the tunnel; and, clearing the way before them, finally emerged by the Port St. Nicholas! The work, which they suppose to be Roman, is, they report, in nearly perfect preservation. A few parts only are in want of repairs, whose cost they estimate at not more than from 16,000*l.* to 20,000*l.*; and proper approaches are all that will then be wanting. The tunnel is a single arch, has a width of more than sixty feet, and is one fourth longer than that of London!

London Athenæum.

Explosion on board the "Gipsy Queen."

It is our painful duty to record a frightful and fatal accident which occurred on Tuesday, Nov. 12, involving the death of Mr. Jacob Samuda (well known on account of his connexion with the Atmospheric Railway,) and nine other persons on board the steamboat the *Gipsy Queen*, lying at the mooring buoy, off Brunswick Wharf, Blackwall; in consequence of one of the joints of the steam-pipe leading from the boilers to the cylinders giving way as explained in the evidence hereafter given. The *Gipsy Queen* is a new iron boat of about 500 tons burthen, recently built by Messrs. Jacob and Joseph Samuda, with a pair of engines of the collective power of 150-horses (nominally) on the bell-crank principle as patented by Mr. Jacob Samuda. For the sake of reference we again give the engraving.



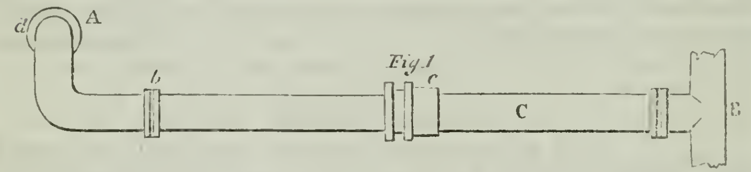
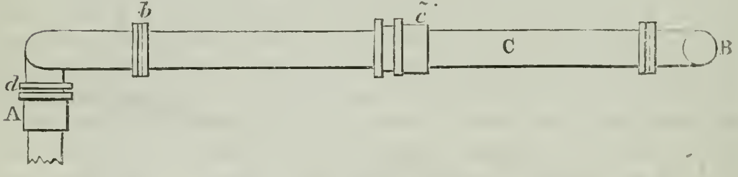


Fig. 1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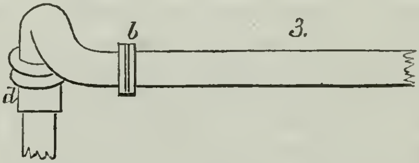
3.

It appears from the evidence that the explosion was in no way connected with the construction of either the engines or the boilers, but simply in the method of making the joints, or rather in the fixing of the steam-pipe leading from the boilers to the cylinders. On the day of the accident the vessel ran down the river to try the engines, which it is stated worked admirably and perfectly satisfactory to all parties present, that during the trip the steam was not more than 10 lb.

pressure, although the safety valves were represented to have been loaded with 25 lb. on the square inch; after the vessel had made the trial trip, she was moored off Blackwall, when Mr. Jacob Samuda felt desirous to try what effect high steam at 25 lb. pressure would have upon the boiler; it was during this experiment that the fatal accident occurred. In order to render the evidence intelligible, we have borrowed of our contemporary, the *Mechanics' Magazine*, the four annexed engravings, showing the pipe and the joint.

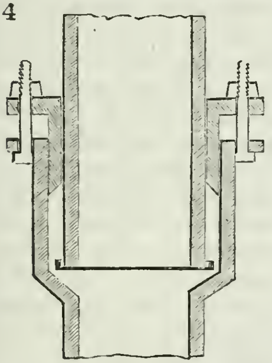
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Fig. 1 is a plan, or top view, of the pipe. Fig. 2 a side view.—Fig. 3 a perspective of the bent pipe at the angle. A is the vertical pipe leading to the cylinder; B the steam-pipe from the boilers; C the intermediate steam-pipe; *b b* joints of the flanch description; *c* and *d* socket or spigot and faucet joints. Fig. 4 is an enlarged view of the socket or spigot and faucet joint, *d*, being the one which is represented as having given way first; the part indicated in black is the place occupied by the ring or bead which was originally on the end of the pipe, and in the evidence stated to have been *chipped* and *filed* away; the joint was packed with hemp and tallow, and surrounded with a *gland* to prevent the packing being forced out by the steam. It is very evident from this description, that we have a packing very similar to that round a piston rod, and in consequence of the bead being cut away, a very low pressure of steam would lift the elbow pipe out of its place; if the pipe be 10 inches diameter the area is equal to $78\frac{1}{2}$ inches, and with a pressure of steam at 10 lbs. there would be an upward pressure of 785 lbs.; consequently, if the pipe was not strapped down, it is very evident that the elbow pipe would be lifted out of its socket in the manner the accident is represented to have occurred. There appears to be some astonishment exhibited by all parties at the inquest, at the bead being cut away and filed, but not a word was said about the *gland*, if the latter was in one piece it is evident that the bead was cut away to get the gland on the pipe, but if the gland had been made with two semicircles and a ring under, also in two pieces, and placed so as to break joint, it might then have been put on without the bead being cut away; if the annexed drawing be a correct view, of which we have no doubt, it is very evident that the gland was in one piece, and consequently it accounts for the chipping away of the bead on the end of the pipe. It is also stated in the evidence that the spigot and faucet joint is necessary to allow for expansion of the metal; for this purpose $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in a pipe 30 feet long, would be ample play, and in a vertical pipe 10 feet long, $\frac{1}{4}$ of an inch; but the principal necessity of such joints is to avoid derangement when the vessel *takes ground;* in such case iron cement joints, as recommended by one of the witnesses, would give way and be perfectly useless. We, therefore, under all the circumstances, cannot see any objection to the socket or spigot and faucet joint, provided it be made with a bead on the end of the pipe, and a proper *gland.* To the defect of the latter do we attribute the fatal accident; having offered these observations, we shall now proceed to quote the evidence given before the coroner, Mr. Baker, at the inquest held upon the bodies of the sufferers.

The Inquest.—Mr. G. Low, an engineer on board of the vessel at the time of the accident, stated that she had two engines worked with two cranks, without an intermediate shaft. They are different from ordinary engines. Are both direct acting engines, and beam-engines. The common beam-engine has cylinders standing athwart the ship, and are parallel with the shafts, but the engines of the *Gipsy Queen* stand fore and aft the boat, with the shafts at right angles, and not parallel at all. Thought that they were not more dangerous than the ordinary steam-engine. The beam of the common steam-engine oscillated in its centre, while the beam in Messrs. Samuda's engine had a motion at the end. In fact, there were two separate beams. He believed that Messrs. Samuda were, in making these engines, under contract to use all the serviceable parts of the engine of an old steamer which the new one was to replace. But whether portions of the old engine were used did not know. Could not say what they were called, as they were not worked up to the power they were intended to be worked at. They were condensing engines. The engines were never working higher than 10 lb. to the inch all the while, he looked at the gauge, till they stopped at the East India Docks. The number of strokes she gave was from 20 to 24 per minute. The safety valve would not rise at a pressure of 10 lb. to the inch. The maximum pressure calculated to go before any mischief might be apprehended was stated by Mr. Samuda at 40 lb. to the inch. He (witness) supposed she was working on Tuesday at nearly 200-horse power. The diameter of the cylinder was 45 inches, and the stroke was (as the reporter understood) 4½ feet. The engines were tried on the Friday previous. She was tried at her moorings. Could not tell what caused the accident. The pipes are perfect at the joints. The pipe is not broken. It is one of the spigot and faucet joints that has been lifted out of its place. Mr. Samuda had no power over the weight in the safety valve; nor any one else. It was in a chest, secure from any person's interference. The weight upon the safety valve was set at 26 lb. Witness differed from Mr. Samuda as to the amount; Mr. S. said it was 26 lb. and he thought it was 27 lb. No steam could blow off at the valve till the pressure was at 26 lb. When Mr. Samuda sent him on deck a very little steam was just oozing out. The motion of the engines had ceased about 10 minutes. The main pipe is joined with what is called a spigot and faucet joint. This was lifted out of its socket. In answer to a question "was there no fastening to the joint? No bolt or screw at all?" witness said it had a packing of hemp. The joint is used to allow for expansion. They were cast-iron pipes, and all these pipes must have these joints for expansion and contraction. Had seen one twice the size. It is the customary mode of joining in all engines that are fitted with cast-iron steam pipes. As already stated, Messrs. Samuda were bound to work up parts of the engines of the old vessel, and the cast-iron pipes were parts of the old vessel. They used the cast-iron pipes, the air-pumps, and the cross-heads. The engines were in their places before he joined the work at all, and he could not speak at all of the quality of the work.

The Coroner said there did not, from the evidence of Mr. Low, appear to be have been any fracture in the pipe from which the fatal explosion had taken place; therefore, the solidity of the material did not become an important point in the inquiry. There was, therefore, on this head nothing to find fault with as far as the evidence had gone. He, however, thought further information should be obtained about the amount of security afforded by the description of joint that had given way. Judging from the evidence, it did not appear to him that there was anything like security against similar fatal occurrences, if the spigot and faucet joint were used under the pressure spoken of by the witness Low. He, indeed, did not see how, with so inefficient a mode for joining steam-pipes, or packing them, as the witness had described it, fatal accidents could be prevented.

Mr. Low's examination continued—The joint which had given way was 14 or 15 feet (as was understood) from the boiler. Had the pressure never been more than 8 or 10 lbs. to the inch, at which the engine worked on her trip, there would not have been any danger, but the additional pressure put upon her required something more than that fixture (viz. the spigot and faucet joint.) The vessel started with the steam pressure at 6 lbs. and while working her they were unable to get it higher than 10 lbs. Had no doubt that the occurrence was entirely accidental. Mr. Pim, treasurer of the Dublin and Kingstown railway, here asked premmission to put, through the coroner, two or three questions to the witness. He (Mr. Pim) was a friend of the deceased gentleman, Mr. Samuda, and being in town he had taken the opportunity of attending the inquiry to elicit facts upon one or two points. I think, Mr. Low (continued Mr. Pim,) you said the cause of the accident did not arise from any peculiarity in the construction of the engine itself? Witness—The primary construction of the engines had no connexion with the accident at all. Neither did it arise from any peculiarity in the construction of the boiler. Neither had the material of which the steam-pipe was composed anything whatever to do with the accident, because the pipe is whole yet, but were I to make the same pipe of the same material I would not make it in the same form. The material of which the steam-pipe was composed did not at all contribute to the accident.

With the view of having the evidence of other practical men, the inquest was adjourned till Saturday, Nov. 16.

The Coroner said that Mr. Hensman, a draughtsman, on board at the time of the accident, and Mr. Low, the engineer, had given some additional evidence on the inquest held on Friday on the bodies of those who had died after their removal to the London Hospital, which would be repeated. The great question was, how to prevent such accidents occurring in future. A brother to one of the men who had died at the hospital, named Riley, and who was on board at the time, was satisfied that this was an accident; but if accidents from similar causes were to occur again, it was desirable for persons to know that death from such a cause would then amount to manslaughter. In a case "the King v. Carr," reported in Carrington and Paine, it was held that where a man made a cannon which burst, and it was sent back to him and repaired, and it burst a second time, that death from such repeated accident amounted to manslaughter. So in this case, if an accident from the same cause were repeated, he should have no hesitation in directing a jury to find a verdict of manslaughter. But Mr. Samuda, the engineer and chief owner, having paid the penalty of his life for this imperfectly constructed joint in the steam pipe, he thought it would be harsh to bring in such a verdict against the younger brother and partner in the firm.

Mr. Low then gave additional evidence, that if a collar, or ring, had been on the end of the spigot pipe, it would have allowed for contraction or expansion, without permitting the pipe to be withdrawn from the socket. It was customary to have such a collar. Its own weight would keep the pipe in its place (?) at a pressure of steam of 10 lb. to the inch, but a pressure of 26 lb. to the inch lifted the pipe out of the socket.

Mr. Henry Hensman corroborated the testimony given by Mr. Low in all respects, except this, that he thought the same pipe, if it had been joined with iron cement, would have been perfectly safe. He did not think that provision for the expansion and contraction of this joint was so absolutely necessary, the expansion of the middle joint being sufficient. The joint as made and packed, would have been perfectly safe, if there had been a stay between it and the deck, or if it had been strapped with an iron strap to the engine, so as to prevent the pipe rising from its socket.

A Juryman—Do you happen to know whether this pipe was new, or was part of the machinery of the old *Gipsy?* Mr. Pim—We shall be prepared in a few minutes to show that it was a new pipe cast for the purpose. A Juryman said it appeared to him, on examination, that the head of the spigot pipe had been chipped off. Mr. Low said it also appeared so to him. He was perfectly satisfied if the late Mr. Samuda had known it, he would have condemned the pipe as unsafe. It must have been done without orders, and ought not to have been done. The Coroner—Might it have chipped itself in coming out? The Juryman—No; that was not the case evidently.

The Jury then retired to consider their verdict, and returned in about half an hour, having found a verdict of "Accidental death." They also expressed an opinion that the deaths of the deceased were "caused by the false and improper construction of the joint of the main steam-pipe, in its not being sufficiently secured; and they express this opinion in order that due caution may be used to prevent similar accidents in future, which, it appears to the jury, may be effected by a collar or ring to prevent the severance of the pipes."

At another inquest held on the bodies of Riley, Donovan and Mills, who died after their removal to the London Hospital, the Coroner remarked that he thought there was decided blame with respect to the fatal occurrence, inasmuch as that the steam had been put to 25 lbs.

to the inch, when it was stated that from the parting of the spigot and faucet joint, it was not capable of resisting steam of that power.

The following evidence was given.

Mr. Low was asked one or two questions as to the position of the steam-pipe, and the place of its separation. He explained that the pipe went up from the boiler vertically, then on a line over where Mr. Samuda was standing at the time of the explosion, and turned down to the cylinder. It was in the centre of the longitudinal portion that the spigot and faucet joint was placed, the parts were forced from each other by the pressure of the steam against the elbow. Witness attributed the yielding of the spigot and faucet joint to the great pressure; but he believed if there had been a collar or ring on the end of the spigot, that being encased in the faucet six or seven inches allowing for expansion and contraction, it would have prevented it from being withdrawn.

Mr. Henry Hensman, corroborated, in all points, the testimony of Mr. Low but he would go further than he had done, and say that the same pipe, if joined by iron cement, would have been perfectly safe. —Mr. Low, being here asked if that was also his opinion, answered in the affirmative.—Mr. Hensman did not think any allowance for the expansion or contraction was absolutely necessary. Being asked by Mr. Pim, who attended on behalf of the friends of Mr. Samuda, whether the joint, as made and packed, would not have been perfectly safe, if there had been a stay upon it to keep it in its place, he replied, certainly. There were two U ties to hold up the horizontal portion of the pipe ; and if the pipe with the joint as made and packed had been strapped to the engines, it would have been perfectly safe, as the pipe would have been prevented from moving either way. —Mr. Pim—Was not the spigot and faucet joint introduced by Mr. Samuda rather as a refinement to avoid accident, and as an improvement? Mr. Hensman—Yes. And in answer to inquiries if there had not been a ring or collar originally to the pipe which belonged to the old engines, the witness said, he believed there had, but that it was cut off probably because the pipe was too long, without Mr. Samuda's knowledge; and if Mr. Samuda had known that the joint had been fitted in the way it was, he would have had it altered. Mr. Samuda could hardly look at every joint fitted by his workmen, although he was always exceedingly anxious personally to see that the work was done in a proper manner.

Mr. Pim observed that the inefficiency of the joints arose from an error of judgment, and not from a want of care, and a juror observed that Mr. Samuda evidently thought it safe, or he would not have placed himself in the dangerous position that he did.

The jury having expressed themselves satisfied with the evidence, returned a verdict of "Accidental Death."

Wire Ropes.

The efficiency of wire ropes, as compared with hempen, became, in rather a curious way, the subject of legal inquiry the other day, on the Northern Circuit. A person of the name of Backhouse, employed in the Wingate Colliery, brought an action against the proprietors to recover a sum of money which he alleged to be due to him under the terms of his pit bond. The defendants pleaded that he had been refused his wages because he had refused to work; to which the plaintiff replied that his refusal arose from the defendant's neglecting to supply, provide, and maintain *sufficient* means of descent and ascent, inasmuch as they had substituted for the old hempen ropes in use the newly invented wire ropes, which were unsafe, dangerous, &c. The real question, therefore, which came to be tried was, whether the wire ropes were as secure as the others? The jury decided in the *affirmative.* We quote the following abstract of the proceedings from the *Times* :—

For the plaintiff a great deal of evidence was adduced to show the insecurity of the wire rope. It appeared that the use of wire ropes in collieries dated only since the end of the year 1842, when they were introduced in various parts, both in working inclines, and raising coals from the pit. Those used on the inclines were chiefly round, while those at the collieries were made flat for the greater facility of rolling them on the drum. In the latter end of the year 1842, a rope of this kind began to be used at the Wingate Colliery. It was in use for about six months, when it met with an accidental injury from the engineman carelessly allowing the cage with the coal to be drawn up too far, and thus to come in contact with the woodwork over the mouth of the pit. The effect was to stop the engine, but the rope did not give way. It was, however, taken off to be examined, and replaced by a hempen one. In April, 1843, the wire rope, consisting of 96 wires, was again put up, and was worked in conjunction with another rope of 144 wires. This latter rope met, in June, with an accident, in consequence of the cage coming in contact with the mouth of the pit, and on examination, it was found that one whole strand of six wires was broken, and that other single wires had given way. It was, however, worked until the evening, when it was taken off for examination, and a hempen one fitted up in its stead. Complaints of the other rope were the next day made by the men. It was alleged that single wires were broken in several places, and that as many as five had given way in one spot. This was alleged as a reason for their not descending to their work. Mr. Armstrong, the manager, expostulated with them on the subject, and endeavoured to show them, that though some of the wires were broken, there was nothing that could at all affect its security. Offers were made on one side and the other to refer the question to some competent authority, but they finally could not agree on a choice of the person or persons who should inquire into the matter; and, on the 10th of June, the parties made their appearance before the magistrate. It was there proposed by Mr. Armstrong that the rope should be tested by a machine, if the men would pay the expense; and he finally offered to test it with a weight of 20 tons as it hung in the shaft. It was finally put to the test, with a weight, however, of 10 tons only, the pulley over which it was carried at the top not being, as was alleged, capable of carrying more.

The result of this experiment was not satisfactory to the miners present. They alleged that the rope yielded somewhat with the weight, and that the strands at the upper part opened. The rope was examined throughout its whole length by a Mr. Chicken on their behalf, and it appeared that 19 wires were broken at different parts of its whole length. Of these, five were broken at one spot and four at another. A piece of the rope was cut off and handed over to them as the subject of any experiment they might choose to make.

A Mr. Galloway, who had been for many years engaged in the manufacture of iron, stated, that he examined the rope in question, which was on the scale of 1 cwt. to four fathoms. He was of opinion that the strength of the rope was diminished in proportion to the aggregate amount of wires fractured. He thought the rope might bear a strain of 27 tons when new, but it would be very injurious to it to expose it to a strain at all approaching to that amount as its elasticity would thereby be permanently injured. The breaking of a single wire shows that all are strained, and that the elasticity of the whole rope is impaired. He thought the rope in question might carry 3½ tons, the usual weight upon it, but would not be safe with that weight in case it met with a jerk.

Other evidence was adduced as to the manner in which the rope stood the test of the 10 tons. It was shown that nine ropes had given way in the Coxhoe and Jarrow collieries. In the former case, however, the rope was flat, and consisted of undivided skeins of wire, laid alongside of each other; in the latter, the rope had been lying idle for six weeks in consequence of the turn out.

For the defence, evidence was adduced to show that a portion of the rope was submitted to a strain of upwards of 19 tons before it gave way, that a single strand of six wires was able to carry upwards of 19 cwt., and a single wire 3 cwt.; that with the test of the 10 tons in the shaft it was perfectly elastic, and that the weight rose and fell some inches, and that on examination afterwards it showed no symptoms of any strain. It was further stated, as the opinion of the scientific witnesses, that the diminution of the strength of the rope would not be in proportion to the whole number of fractures, but to the number at one spot. The cohesion of the wires from the twisting of the rope is such, that a wire at the extremity of the rope, fractured 5 inches from that extremity, will not pull out from the rest, but break if a sufficient weight is applied. So much is this the case that a single strand of the rope in question, consisting of six wires, had individual wires divided at different places throughout its whole length, so that every wire of the six was divided within the space of every foot, and yet even in that state it bore a strain of 12 cwt. 3 lbs. before it gave way. The weight usually carried by the rope at Wingate Colliery was three tons and a half.

Evidence was also adduced of the fact of wire ropes being used at various collieries throughout the country, and that they were generally looked upon as much safer than hemp; that they were better, and that any symptom of weakness was sooner perceived.

The Jury, after being for some time out of the box, returned a verdict for the defendants. Lond. Mechanics' Mag.

AMERICAN PATENTS.

List of American Patents which issued in the month of September, 1844, with Remarks and Exemplifications. By Charles M. Keller, Examiner of Patents.

1. For a machine for *Shaving and Splitting Wood;* William Rose, Philadelphia, Pa., September 3.

The operative parts of this machine consist of a horizontal wheel, around a portion of which is arranged rollers for conducting the pieces of wood to be split, or shaved, or both together, with the knives and a trough for feeding in the wood. The rollers are placed on vertical shafts provided with pinions at their lower end, that gear into a cog wheel on the shaft of the horizontal wheel. The splitting knife is placed between the periphery of the horizontal wheel and the first feed roller, and is attached to a stock jointed to the frame above, and connected by a loop with the shaft of the feed roller, mid-way between the roller and the lower journal of its shaft, so that when the roller is pushed from the periphery of the wheel, by the thickness of the piece of wood fed in, or forced towards it by a pressure spring (the upper journal working in a slide to admit of this,) the knife will move just half as much as the roller, and thus occupy a position mid-way between the wheel and roller to split the piece of wood in half. The shaving knives are permanently attached to the frame at any required distance from the periphery of the wheel. The upper ends of the shafts of all the rollers work in slides, and are provided with pressure springs. When the pieces of wood are to be shaved thinner at the ends, there is a cam-formed piece, or projection, on the periphery of the wheel, which forces the wood towards the permanent or shaving knives—and for the purpose of shaving the edges of staves and other articles, cutters are jointed to the frame above and below the horizontal wheel, and so arranged that properly formed cams on the wheel, cause them to approach and recede from each other in proportion to the form to be given.

Claim. "What I claim as my invention, is the combination of the revolving wheel and cams, with the rollers and knives for splitting and dressing pieces of wood, as described."

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2. For a machine for *Splitting Hoop Poles;* William Rose, Philadelphia, Pa., September 3.

This, in its chief characteristic, resembles the preceding machine, and is for the purpose of splitting without shaving; but instead of feeding and carrying the wood between a wheel and rollers, there are two sets of feed rollers, the lower ends of the shafts of which are geared together, and the upper ends of one of each set work in slides, and are provided with pressure springs. The hoop pole passes in between the first set, and is presented to the edge of the cutter or knife by the other set, the edge of the knife being between the two rollers, and hung in the same manner as in the preceding machine; the connexion between the shaft of the movable roller and the knife stock being by means of a crutch, or forked bar. The stock is extended below this connexion, and is provided with an oblique adjustable bar, which passes through guides to insure the proper position of the knife.

Claim.—"What I claim as my invention, is the manner of changing the position of the knife, so as to bring its cutting edge to the centre of the hoop pole, whatever its diameter may be, by means of the aforesaid combination of suspended knife stock, crutch bar, and oblique adjustable bar, or other means substantially the same."

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3. For improvements in machinery for *Pressing Bonnet Tips;* Thomas Kendall, New York city, N. Y., September 3.

This is for pressing that kind of bonnets which have the crown narrowed in and then swelled out towards the upper part, or tip. The mould or block iron, on which the bonnet is put to be pressed, is made with two movable parts towards the tip, called the "movable ball," these are placed one on each side of a wedge-like projection on the block, and the outer faces of these pieces are grooved and swelled to give the desired form to the tip of the bonnets, so that when the block is put in and forced down, the movable pieces are forced outward and give the desired form. These parts are connected together by pins and grooves to keep them together and admit of their moving outwards. This mould is provided with an upper and lower heater holder in the usual way, and with a matrix; and in addition to these, there is a pair of forceps, so formed as to embrace the "movable tip," and to admit of putting in and removing the mould, or block, with the bonnet thereon.

The claim is limited to the movable parts of the mould, when used in combination with the forceps, and with the upper and lower heater holders, and the lower cup, or matrix.

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4. For an improved mode of connecting the *Elliptical Springs of Carriages;* Erastus T. Sprout, Dimock, Susquehanna Co., Pa., September 7.

The improvement in question, is for connecting together the elliptical springs of carriages on the front and back axles, by means of two horse-shoe springs; the open ends of the horse shoe springs being bolted to the upper and lower parts of the elliptic springs, and their curved or bow parts connected together by a screw swivel box and clevises, or clasps, so that the connexion between the two can be regulated by the screw swivel box to increase or decrease the tension of the springs, and thus prevent the longitudinal rocking of the carriage.

Claim.—"What I claim as my invention, is the combination of the two shoe springs, connected together by means of the swivel box and clevises, or clasps, and the elliptical springs, in the manner and for the purpose specified."

5. For an improvement in the apparatus for *Heating Buildings with Hot Water;* Benjamin Blaney, Boston, Mass., September 7.

This is for an improvement in the method of heating air for heating buildings, by the circulation of hot water through a series of tubes in a hot air chamber. The patentee says—"My apparatus consists in part, of a furnace and a vertical boiler. To the upper part of this boiler is attached a box, which I denominate a water trap, said water trap being intended to receive the water which by its ebullition is caused to flow into it from the boiler. From the bottom of the water trap, the heated water passes along and descends through a series of recurved pipes contained in an air-heating chamber, and from the lower part of these it again passes into the lower end of the boiler, and is thus kept constantly circulating while ever a fire is maintained in the furnace. The whole apparatus is to be contained within a suitable chamber, made perfectly close, excepting where provision is made for giving access to the furnace, and the opening or openings made for the admission of the air from without, which is to be heated, for the purpose of being conveyed through tubes into the apartments to be warmed."

Claim.—"What I claim therein as new, is the manner in which I have connected the boiler with the series of tubes or pipes, through which the heated water is to circulate, by combining therewith a box or vessel, such as that which I denominate a water trap, into which the boiling water is to pass, in consequence of its ebullition, and through which, as well as through the tubes connected therewith, and through the boiler, said water is to circulate for the purpose and substantially in the manner set forth."

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6. For improvements in the *Brick Press;* Collins B. Barker and E. Gifford, Troy, N. Y., September 7th.

This machine is double acting, that is to say, it is furnished with two moulds, and two pistons or followers, so arranged as to operate successively at each end of the machine, the bed of which is placed horizontally. There are two slides, moving in suitable guide pieces, one of which has a piston, and the other a mould, at each of its ends. These slides are moved back and forth by cams, placed upon a horizontal shaft which crosses the bed of the machine at its middle, and is made to revolve by any adequate power.

Claim.—"What I claim as new, is the manner in which we have arranged the moulds and pistons, or followers; the moulds and followers being affixed on either end of a slide, and said slides being moved back and forth, and the bricks pressed against a stationary plate or head, (at each end of the frame,) in the manner described, the whole arrangement being substantially such as is herein set forth."

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7. For improvements in the *Steam Engine;* Benjamin Crawford, Alleghany, Pa., September 7th.

Claim.—"What I claim, is the method of working the condenser of a Steam Engine, without the aid of an air pump, by so combining it with a valve which opens from an escape pipe into a water heater, and with a foot valve which discharges into the open air, or into a reservoir of water—by which combination the steam which enters the condenser, escapes partly through the upper valve into the heater to heat the water for the boilers, and carrying with it a portion of the air from the condenser, and partly through the foot valve, carrying with it the water and air of the previous condensation; and when by these operations, the elastic force of the steam is reduced below the atmospheric pressure, the valves are closed, and the remaining steam condensed—all as described.

"I likewise claim the manner of preventing the water from flowing from one boiler into another, when the boat careens, by means of tubes, as described."

The condensation is effected by a jet of water introduced in the usual way. And the manner of preventing the water from flowing from one boiler to another, when the boat careens, is by forming the connexion between the two boilers by a tube, or tubes, which extends nearly to the off side of the two boilers, so that the careening of the boat carries that end of the tube which is in the upper boiler above the level of the water.

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8. For an improvement in the manufacture of *Salæratus;* Edward Chamberlin, Boston, Mass., September 7th.

Instead of suspending common pearl ash in distillers' or brewers' fermenting vats, to be carbonated under the process covered by this patent, it is suspended in a vessel through which the volatile products of the combustion of anthracite coal are passed, by connecting this chamber with a stove or other fire chamber, the pipe between the two being enlarged and provided with sieves to prevent the passage of fire and fire dust, or ashes, which are always found in the flues of fire places. Steam, from a steam boiler, is also, from time to time, introduced into the chamber containing the pearl ash.

Claim.—"What I claim consists in the employment and use of anthracite, *i. e.* its volatile products of combustion, in connexion with steam, without any purifying process of the volatile products of combustion, other than the separation of fine dust, as set forth, the whole being substantially in the manner and for the purpose specified."

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9. For improvements in machinery for *Combing Wool;* George E. Donisthorpe, Bradford, England, September 11, 1844, to run fourteen years from the 25th of November, 1843, the date of the patent in England.

In this machine the teeth on the main or carrying wheel project from the rim of a wheel in lines parallel with the shaft, as in machines previously known and used; and the teeth of the combs that act in connexion with these are made coarse at one end, and gradually finer towards the other, and the fine end is placed nearer to the carrying teeth on the wheel than the other; and the working combs have in addition to their rotary, a movement towards and from the carrying teeth; and the wool is applied to the carrying teeth, by means of feed rollers, that not only cause the wool to advance, but also lash or lay it on to the teeth.

Claim.—"What I claim is arranging the teeth of the working combs at variable and decreasing distances apart, from one end of the comb to the other, as set forth (whether the said comb consists of a straight row of teeth, or several circular rows, or cylinders,) in combination with arranging the said teeth in such manner that as they increase in distance asunder, they shall increase in distance from the teeth of the carrying combs, or in other words, arranging the teeth of the working combs at increasing distances apart from each other, and from the carrying combs, as set forth.

Also, giving to each of the rotary working combs (when revolving and working with the teeth of the endless carrying combs,) a movement towards the common axis of the set of rotary working combs: the same being for the purpose specified.

Also, the manner of discharging wool from the teeth of the working combs, viz. by means of the sliding plates, &c., applied to the said teeth, and operated as set forth. Also, I do not claim the employment of one or more set of feed rollers for supplying the carrying combs with the fibrous material, but that which I do claim consists in the described manner of arranging and operating those feed rollers with respect to the carrying combs (or teeth thereof,) so as to cause them to lash, lay, or apply, the wool upon the said teeth, as specified, the said feed rollers and carrying teeth being arranged with respect to each other, and being operated, or depressed and elevated as described."

10. For improvements in the *Argand Lamp;* Edwin B. Horn, Boston, Mass., September 11th.

We have here a patent granted for improvements in that class of Argand lamps in which the oil is forced up from a reservoir in the pedestal, to a fountain surrounding the burner, by a weight or other means of making pressure on the oil, in the reservoir below. The first of these improvements is for regulating the supply of oil to the fountain above, by means of a float provided with a valve which closes the aperture in the pipe through which the oil is forced from below, there being an air and oil passage between the fountain and the burner. And the second is for a device, fully expressed in the claim.

Claim.—"I shall claim the combination and arrangement of the burner and fountain, containing the float with the air and oil passage between them, substantially in the manner described. Also forming one or more openings through the inner side of the upper part of the fountain, for the escape of the air and surplus oil, in the manner, and for the purpose set forth."

11. For an improvement in the *Rotary Steam Engine;* Edward Locke, Newport, England, September 11th.

The improvement in question is on an engine patented to J. J. Cordes and Edward Locke, on the 29th of March, 1841, and noticed in the third series of this Journal, vol. iii, page 345, to which the reader is referred, to enable him to understand fully the following

Claim.—"I claim as my invention, the application of a separate steam cylinder, or engine, distinct from the main rotary engine, but which may be worked by steam from the boiler, for working the exhausting apparatus, by which the vacuum is kept sufficiently perfect in the case of the main revolving wheel, instead of depending on the revolution of the main revolving wheel itself, to work the exhausting apparatus for producing the required vacuum for it to revolve in."

12. For a mode of adapting a *Circular Saw to a Scow or Vessel for Cutting piles under Water;* Erastus E. Cole, Boston, Mass., September 14th.

The journals of the saw shaft work in a frame which slides in ways attached to the scow, or vessel, and provided with a counter weight to balance the saw and sliding frame, so that the motions of the vessel occasioned by waves, &c. in harbors, shall not affect the operation of the saw.

Claim.—"I claim the sliding saw in combination with the scow, or other floating body, for the purpose as herein specified."

13. For a machine for making *Sand, Glass, or Emery paper;* Edmund Morris, Philadelphia, Pa., September 14th.

The paper receives the glue from a rotary brush, that takes it from a distributing roller and vat, and then passes under another rotary brush which spreads it more equally; from this it passes under a sieve to receive the sand, glass, or emery, and then on its way to the roller on which it is rolled up, it is acted upon by the wings of a knocker, which throws off the surplus sand, &c.

Claim.—"What I claim is the combination of the knocker with the sieve, or other suitable apparatus, for distributing the sand, glass, emery or other suitable material, and with appropriate rollers and brushes, whether arranged precisely in the manner herein described, or in any other that is substantially the same, producing a like result by analogous means."

14. For an improvement in the *Press for Cotton, Hay, &c.;* Wm. F. Provost, Barnwell District, South Carolina, September 14th.

The follower of this press acts upwards against the head block.—The pressing levers are jointed by their upper ends, to the under side of the follower, and by their lower ends to two rods called "swinging fulcra," which are jointed to the outer ends of the head block, or cap piece, of the press; and at the junction of the pressing levers and "swinging fulcra," there are rollers, around which ropes pass to draw the lower ends of the levers together, and thus force up the follower.

Claim.—"All I claim in the before described arrangement, is suspending the swinging fulcra of the pressing lever of the follower, to the head block, or cap, of the frame, against which the substance is pressed in the manner and for the purpose set forth."

15. For an improvement in *Reaction Water Wheels;* Roswell Cook, Elkland, Tioga county, Pa., September 4th.

Claim.—"What I claim is the peculiar construction of the buckets of the wheel, that is to say, starting from the top of the hub, at the circumference thereof, and diverging from it in a spiral manner to the middle of the bucket, from which point it gradually approaches the next succeeding bucket, till within such distance as is requisite to form a narrow issue descending from the upper edge of the bucket at an angle of about 45 degrees with the bottom thereof, to which it unites near the bottom of the next bucket."

16. For an improvement in *Fish Nets;* John Carr, Jackson Shannon, and William Carr, Sunbury, Northampton county, Pa., Sept. 14th.

The Patentees say,—"The nature of our invention consists in dividing a cylindrical net into different compartments, and furnishing each with a bait bag, the bait being suited to the different kinds of fish, and the large fish being prevented from entering the compartments of the smaller ones."

Claim.—"What we claim as new, is the combination of a series of compartments in the manner and for the purpose described. We also claim the combination therewith of the bait bags, as specified."

The different compartments are separated by diaphrams of net work and funnels, the meshes in each succeeding one being smaller, so as to admit the kind of fish to be caught in the second compartment to pass through the first division, those to be caught in the third to pass through the second division, and so on.

17. For improvements in the *Process of manufacturing Iron and Steel;* Thos. Southall and Charles Crudgington, Kidderminster, England, Sept. 14th.

Claim.—"We claim the introduction, into the melted iron, &c., of a compound of sulphur and a nitrate, either alone or combined, with either or all the ingredients enumerated in the foregoing description, as described, whether the proportions hereinbefore given be followed or changed."

The other ingredients with which the sulphur and nitre may be mixed, are borax, soda, or potash, and alum.

"The materials are broken into a small granular state, and equal parts, by weight, of sulphur, nitre, borax and alum, with half a part, by weight, of soda or potash, are to be well mixed together. These mixed matters are to be made up into parcels of about one and a half pounds each, that quantity being proper for treating about four hundred weight of pig iron, and in like proportion for any quantities of iron in the puddling furnace. These proportions are used when it is wished simply to improve the quality of the iron, but when it is desired to convert the iron into steel, then about four pounds or more of the mixture are required for each four hundred weight of iron."

18. For an improvement in the method of *Cutting Raw Hide;* Wm. Marshall and John B. Thursby, Brooklyn, N. Y., Sept. 14th.

"The nature of this invention consists in the application of circular cutters or shears, in combination with guards and a traversing pin, made in such manner as to determine the width to be cut, and maintain a circular and lateral movement of the hide in its way towards the shears. The shears, by a circular movement, being brought to act upon and cut a strip from the outside edge of the hide of the requisite size for making rope, or for other use."

Claim.—"What we claim, is, first, the application of the circular shears, in combination with the guards, to regulate the hold which the cutters take upon the raw hide, as described; secondly, the application of the traversing pin as an axis for the circular sheet of raw hide to revolve upon, and to carry the hide, by a lateral movement, towards the shears, in combination with the shears and guards, as described."

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19. For an improvement in the mode of *Printing in Colors,* denominated the *Polychromatic Printing;* Thomas F. Adams, Philadelphia, Pa., Sept. 17th.

"The nature of this invention consists in combining several ink fountains together, so as to distribute ink therefrom on to the rollers that pass over the form in strips surrounding said rollers, so that the different lines of type will be inked with different colors."

Claim.—"What I claim, is the combination of a series of separate and complete inking fountains, constructed and arranged substantially as described, with a common inking apparatus, so as to impart to the ordinary inking roller various colored inks at one operation, in the manner and for the purpose set forth."

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20. For an improved *Basin or Platform,* to be used in connexion with a Dry Dock, for raising vessels and landing them on separate cradles on Railways; Rutherford Moody and Samuel D. Dakin, New York City, N. Y., Sept. 17th.

This is for an improvement on the mode of employing Floating Dry Docks patented by them on the 24th of November, 1843, and not yet noticed in this journal, which consists in providing a basin to receive the floating Dock when the vessel is floated up, and permit it to sink and rest on the bottom thereof, that the vessel may be drawn off, by means of a cradle, on to a railway on shore, so that the floating Dock may be used for raising any number of vessels and deposit them on the shore. The present patent is granted for the addition of a gate to this basin.

Claim.—"What we claim, is the employment of a turning, floating, or swinging, gate, or a gate of any other form, for the purpose of excluding water from the basin above described, to be used in combination with the said basin and the elevating or floating dry dock, above mentioned."

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21. For an improvement in the method of *Coating Iron or Copper with tin and with zinc, or other metal;* Edmund P. Moorewood,

England, Sept. 17th, 1844, to run fourteen years from the 4th of May, 1843, the date of the English Patent.

The metal to be coated, after being cleaned in the usual manner, receives the first coating of tin by deposit from a solution of a salt of tin, the metal to be coated being immersed in a vat containing the solution, and put in contact, above and below, with pieces of zinc.—This coating of tin is then covered with a second coating of zinc or other suitable metal, in the molten state. The machine for applying the second "consists of a pair of rollers, one above the other, together with what is called a back roller, which rollers are placed in a suitable frame, to sustain the gudgeons, or bearings. The back roller is used for the purpose of raising the sheets, or plates, out of the bath; but a bar of metal, or other device, may be made use of for this purpose. The pair of rollers are made to revolve in opposite directions, so that when a plate is introduced between the rollers it is carried forward by their revolution, and falling upon the back roller, which is placed above the level of the lower roller of the first named pair of rollers, and is situated as near as convenient to the pair of revolving rollers, is so far curved upwards that its end finds its way out at the surface of the molten metal," which is contained in a bath, the rollers being in the molten metal.

Claim.—"I claim the coating of sheets, or plates, or pieces, of iron, or of copper, by the combination of the two operations above described, in the manner above set forth, or any other substantially the same, whereby the sheets, or plates, or pieces, of iron, or of copper, are first coated with tin by precipitation, and then passed through a bath of molten metal, as above described, in order to give the second coating. I further claim as my invention and improvement, the machine or apparatus, for coating plates, or sheets, or pieces, of iron, or of copper, said apparatus or machine being constructed and arranged in the manner described, or in any other manner which is substantially the same. But as the processes of coating first by precipitation, and secondly by means of a bath of molten metal, may be combined and consecutively used, without the aid of the machine herein described, and as I believe this combined process to be substantially new, I claim said combination whether the second process be performed by the aid of the machine or by that of dipping in the ordinary way."

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22. For improvements in the *Permutation Lock;* Robert Newell, New York city, N. Y., September 17th.

The patentee says—"A main object of my improvements is to prevent the discovery of the position of the parts on which the security of the lock depends, either by the use of lights, or reflectors, introduced through the keyhole, or by an indication obtained by the lifting of the tumblers for the purpose of ascertaining the positions in which the followers and slides have been left by the operation of the key and bits at the time of the last locking. This I effect, in part, by the manner in which I have formed, arranged and combined a series of followers, slides, follower levers, and their appendages, and in part by the aid of what I have called guard plates, which form two distinct departments or separate chambers in the lock, thereby cutting off all visible communication with the said followers, slides, follower levers, and other parts."

We are under the necessity of omitting the claim, as it refers to and wholly depends on the drawings.

23. For a machine for *Cutting and Clearing Land of the Rattoon of Sugar Cane;* Norbert Lauve, Plaquemines, Louisiana, September 17.

The machine is made with two side pieces in the form of sleigh runners with handles like a cultivator at the back, and connected together, back and front, by two arch pieces; at the forward end there is a roller, and back of it two cutters, one following the other, with the cutting edges curved, and at the back there is a double edge cutter or cultivator, called in the claim a fluke, because of its resemblance (it is presumed,) to the fluke of an anchor. In the claim the first cutter is designated by the letter F and the second by the letter G. These cutters run on the surface of the ground, or a little below it, and are made adjustable by screw bolts.

Claim.—"What I claim is the manner in which I construct my rattoon cutter and plant cane scraper as described, that is to say, I claim attaching to the bottom of the two sled runners the curved knives F and G in the manner substantially as set forth; and in combination therewith I claim the fluke for clearing off the trash and dirt, constructed and arranged substantially as set forth. I also claim the combination of the roller with the above arrangement of knives, said roller being arranged in the manner and for the purpose set forth."

24. For an improvement in *Coffee Boilers;* Daniel Rowland, Washington City, D. C., September 17.

This is for a mode of packing the joint formed by the union of a coffee pot and a condenser placed above, to condense the vapor rising from the coffee, and thus prevent its escape. The condenser is a cylindrical vessel containing water, and placed on the top of the coffee pot, by means of a flanch on the former, which slips over the latter. The lower edge of the flanch is turned in to hold a ring covered with cloth to form a packing.

Claim.—"What I claim is the mode herein set forth of securing the packing between the condenser and the coffee pot by means of the ring covered with cloth and the turned edge of the condenser by which it is fastened."

25. For an improvement in *Block Letters, Numeral Figures, Ornamental Mouldings, &c.;* Lewis Katen, New York city, N. Y., September 20.

This improvement consists in making block letters, or numeral figures, mouldings, cornices, or other ornamental parts of buildings in detached frames of metal, wood, or composition, and fitting stained glass into the frames, or inclosing gold or silver leaf, tin foil, or other coloring matter behind glass, or other transparent substance, in the said frame with cement, so as to be impervious to air or moisture,

Claim.—"What I claim as my invention, is the introduction into block letters, numeral figures, ornamental mouldings, cornices, and ornamental parts of buildings, of a coloring matter behind a plate of glass or other transparent substance in a manner which shall render it permanent and not liable to be tarnished by exposure to the air and moisture, in the manner set forth."

26. For improvements in the machine for *Sticking Pins;* De Grasse Fowler, North Bradford, New Haven county, Connecticut, September 20.

The pins are delivered from a hopper on to the conductor, which consists of two pieces of metal (placed at such distance apart as to receive freely the shanks of the pins and not the heads,) which have an inclination in the direction of their length, and the delivery end is curved to deliver the pins horizontally into the grooved slide of the sticking machine. The upper edges of the two pieces are beveled for a small portion of their length, to form a gutter for the reception of the pins, and at the termination of the gutter they are beveled in the reverse direction to discharge the surplus pins into a gutter on each side to carry them off. This operation is facilitated by an angular piece of metal (designated in the claim by the letter *e*,) placed on the top of the conductor, which directs the surplus pins into the gutters.

Claim.—"What I claim as my invention, is—First—the combination of a sliding bed in which the grooves are cut for the reception of pins, with the stationary curved conductor, combined and arranged substantially in the manner and for the purpose set forth. Secondly—I claim the stationary conductors having two inclined bars with a downward curvature at the ends, as described, and in combination therewith the gutters on each side into which the surplus pins pass, and are carried off, the triangular piece *e* aiding in the operation.—In the above claim I wish it to be understood that I do not claim the inclined conductors when made straight, but only with the curved terminations."

27. For improvements in *Balances;* James H. Ball and Richard H. Ball, New York city, N.Y., September 20.

The following claim indicates the improvements so clearly as to render explanatory remarks useless:

Claim.—"What I claim is, the combining of a spring balance with the various kinds of lever balances to which it may be adapted, for the purpose of rendering the weighing of merchandize more easy, certain, and expeditious; and this we claim whether the spring balance be used with or without our improvements upon it herein described; secondly, we claim in combination with the spring balance described the addition of a second hand. Thirdly—We claim the spring balance described, consisting of the modes of preventing the trembling motion of the hands, viz., the liquor cylinder and dasher."

28. For an improvement in *Cooking Stoves;* James Lewis, Amsterdam, Montgomery county, New York, September 20.

This improvement is for "forming a double flue around the oven, by which arrangement the heat is made to circulate twice around the oven instead of once, thereby causing the cooking operations of the oven to be performed with much less fuel than heretofore consumed, and more equally." The oven is below the fire place, and the draught passes from the fire chamber down the outside flue, along the bottom under flue, back again under the oven, up the same side that it descended, but in the inner flue; then between the top of the oven and bottom of the fire place, down the inner side flue, and up the outside flue on the same side to the pipe. There are dampers to carry the draught directly out if it is not desired to heat the oven.

Claim.—"What I claim, is making the stove with an additional flue around the oven in the manner and for the purpose set forth."

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29. For an improvement in *Horse Hames;* Joseph K. Slater, and Sylvester G. Pratt, Boston, Mass., September 20.

This is for an improvement on improved hames, patented by Nathan Post, on the 15th of June, 1844, and noticed in this volume, page 90, and to which the reader is referred. The improvement consists in extending each of the bearers or purchase bars, which spring from the middle of each hame downwards as far as the lower end of the hame, by an intervening connecting piece of metal; or instead of connecting them in such manner, the bearer may be made of sufficient length, and be bent at right angles, and fastened at its end to the end of the hame.

Claim.—"Having thus explained our improvement we shall claim the same, that is to say, connecting the lower ends of the hames and bearers substantially as set forth, and for the purposes set forth."

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30. For an improvement in *Cut-Off Valves in Steam Engines;* Barnabas H. Bartol, Cold Spring, Putnam county, New York, September 20.

The valves are those known as slide valves, the seat of the cut-off being above that of the steam valve, and the former is operated by an arm on the stem of the latter acting against stops on the stem of the cut-off valve, the stops being adjustable for the purpose of regulating the cut-off.

Claim.—"What I claim as constituting my invention, is the manner in which I have combined the action of the cut-off and steam valves, by means of the arm attached to the stem of the steam valve, and the movable or sliding cams or stops, made adjustable on the stem of the cut-off valve, for the purpose of regulating the cutting off of the steam, by the action of the respective parts as herein described and made known."

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31. For an improvement in *Ships' Sails;* Archibald Trail, Great Britain, September 24th, 1844, to run 14 years from the 24th of February 1844, the date of the English patent.

Claim.—"Having described the nature of my invention," says the patentee, "I would have it understood that I do not confine myself to the precise details described, and it will be evident that the directions of the strengthening cords, bands, or lines may be varied so long as the peculiar character of my invention be retained. But what I claim is the mode of manufacturing sails by applying strengthening cords, bands, or lines, crossing each other on opposite sides of the sails in such a manner as to support the canvas at intervals as described, and thereby giving additional strength to sails for ships and vessels."

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32. For an improvement in the machine for *Excavating Ditches;* Edwin Owen, Laporte, Louisiana, September 24.

To the forward part of the machine there is a triangular cutter lying horizontally for the purpose of clearing and cutting away bogs, brush, &c., and back of this shield, boards inclining backwards on each side from the beam, to carry the cut bogs, and brush, &c. beyond the surface to be ditched; back of these there are inclined cutters to form the sides of the ditch, which are attached at botton to the cutter which forms the bottom of the ditch, and then come the mould-boards in a wedge form, the angle forming a cutting edge inclining backwards from the beam to the cutter. The mould-boards carry up the earth beyond the sides of the ditch, by two curved conductors attached to beams placed above the mould-boards.

Claim.—"What I claim is, the combination of the triangular horizontal knife and shield in the manner and for the purpose set forth. Lastly, I claim the combination of the conductors with the mould-boards in the manner and for the purpose specified, said mould-board being made to slant under at its front edge to facilitate its clearing."

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33. For an apparatus for *Preserving Fruits and Vegetables by means of Ice;* Peter Kephart, Uniontown, Carroll county, Maryland, September 24.

The preservation of fruit or vegetables is to be effected by placing them in a chamber surrounded by ice, or water nearly at the freezing point, the apparatus being so contrived as to admit of changing the ice or water. The whole design being predicated on the fact that vegetables and fruits can be preserved for a great length of time in a perfect state by keeping them at a temperature near the freezing point without freezing.

The ice is deposited on the top of the compartment for fruit, &c., and the water therefrom circulates around the sides and bottom. And there are also tubes surrounding this compartment through which water of a higher temperature can be passed to moderate the temperature should there be any danger of freezing.

Claim.—"What I claim is the so constructing of said apparatus, in the manner described, as that the substances contained in the preserving compartment may be subjected to the influence of the ice deposited on the covering, in conjunction with that of ice cold water produced by its melting; or to the additional influence of a thin stratum of ice surrounding the sides of said compartment; or to the moderated temperature produced by the supplying of water to the tubes or troughs; the respective parts being combined, arranged, and operating substantially as set forth."

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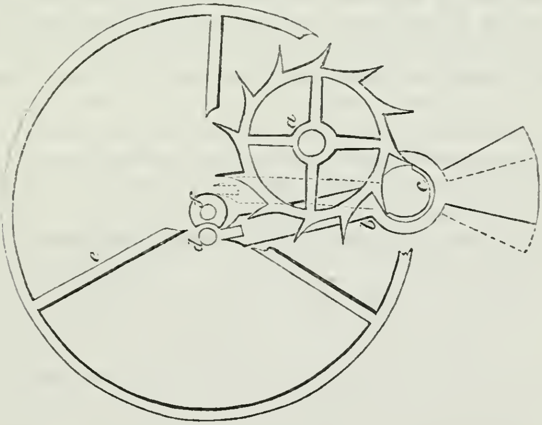
34. For an improvement in *Escapements of Chronometers, Watches, Clocks, &c.;* Oramel W. Waste, Pittsford, Monroe county, New York, September 24.

"The nature of my invention," says the patentee, "consists in applying detents, or a detent cylinder, to the lever as it is used with the roller and jewel pin in the lever watches now in use, and placing the staff of the balance in such a position with the scape wheel, so that by its teeth being locked and unlocked in a peculiar manner, the balance may receive its impulse directly from the teeth of the scape wheel, as in the chronometer and duplex watches, without being subject to many of its disadvantages."

The accompanying diagram will convey to the mind of the reader a much better idea of the arrangement than a lengthy description.



Claim.—"What I claim, is the application of detents, or a detent cylinder, to the lever as it is used with the roller and jewel pin in the lever watches now in use, also the manner of constructing my detent cylinder, as described, also the arrangement attained in the use of the detents or detent cylinder as combined with the lever, as described, together with the placing of each of the three axles of this escapement so that, by their relative position with each other, they shall produce in connexion with the detents or detent cylinder, the above described locking and unlocking of the teeth of the scape wheel, so that the balance shall receive its impulse on the jewel pin at the time the tooth shall pass the whole distance from one detent to the other, it being $\frac{9}{10}$ths or a greater part of the distance from the point of one tooth to the point of the next, and shall pass the remaining tenth or lesser distance as it is unlocked by the balance returning, as described. And I also claim the right of applying my escapement in the construction of chronometers, watches, clocks, and such other instruments or machines to which it may be advantageously applied."

35. For an improvement in *Trusses for Hernia;* Charles C. Reinhardt, and Valentine Carter, Baltimore, Maryland, September 24.

The pad is so connected with a spring lever, projecting downwards from the main spring, to which it is jointed, as to have a free movement thereon.

Claim.—"What I claim is, combining the pad having a motion on its own axis] with the main spring of the truss by means of the jointed lever, the construction, arrangement, and operation of the whole being substantially as specified."

36. For an improvement in the *Chair for Invalids,* called the "*Therapeutic Chair;*" James G. Holmes, Charleston, South Carolina, September 24.

The patentee says—"The principal characteristic feature of my chair is the peculiar manner in which I have combined the seat with the back, with a jointed apron in front, and with the lower frame of the chair, so that a person sitting therein, can by his own weight operating on the back, cause the back and the apron to assume a horizontal position, and to constitute a couch; or can cause the back and the apron to stand at any inclination to the bottom that may be desired; and can also, by allowing his weight to press upon the seat, elevate the back, and depress the apron at pleasure, from a horizontal or inclined position.

The back is jointed to the back part of the frame, and the apron to the front, and the seat instead of resting on the frame is jointed to the back and apron above their junction with the frame.

Claim.—"What I claim, is the manner in which I have combined the seat, the back, and the apron with each other, and with the lower segment or legs of the chair, as set forth, by which combination and arrangement the person occupying the chair is enabled by the action of his own gravity, to govern the position of the moving parts; the whole being connected and combined substantially as described."

37. For an improvement in the manner of *Making Bricks;* William T. Peters, Executor of Ithiel Town, New Haven, Connecticut, September 27.

This "consists in making the bricks hollow with partitions connecting the sides and ends.

Claim.—"What I claim, is the method of constructing bricks of the forms described, in the manner and for the purpose set forth, having the interior hollow and intersected with partitions, as described."

38. For an improvement in the *Reaction Water Wheel;* Theodore R. Limby, Cato, Cayuga county, New York, September 27.

The claim will convey to the reader as distinct a notion of the construction of this wheel as could be given without drawings.

Claim.—"What I claim, is the peculiar spiral form which I give to the channels of said wheel, from their upper ends to their delivery openings, such openings being, in all cases, substantially the same with that made known. I likewise claim the lessening of the delivery openings by means of gauge plates, whether effected in the manner set forth, or in any other that is substantially the same.

The gauge plates are attached to the wheel at right angles to the delivery, in such a manner that the size of the delivery can be contracted and enlarged at pleasure.

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39. For an improvement in the *Churn;* A. C. Stiles, South Bloomfield, Pickaway county, Ohio, September 27.

The box of the churn is divided into two chambers by a perforated partition, and in each of these there is a dasher, the stem or rod of which is jointed to an arm from a rocking shaft at each end of the box, and the two rocking shafts are connected together and to a hand lever by a connecting rod jointed to a pendulous arm at the end of each rocking shaft and to the hand lever placed mid-way between the two. The arms are so connected that when one dasher rises, the other descends. The box is placed on rockers, so that by the operation of working the dashers by the hand lever, the box is rocked and thus the cream is acted upon by the dashers and forced through the holes of the partition by the combined action of the dashers and the rocking of the box.

Claim.—"What I claim is the combination of the rockers and dashers in the double chambered churn, and for the purpose set forth."

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40. For an improvement in *Telegraphic Communication,* denominated the *American Semaphore;* Henry J. Rogers, Baltimore, Maryland, September 27.

This invention "consists in the combination of a series of balls, disks or lamps, a row of which are placed in a line, which it is preferred should be vertical, as numerators, and moving other balls in lines parallel therewith that are decimally arranged for denominators by means of chains or other analogous contrivances for land or sea service. Or for sea service alone signal flags may be used.

Claim.—"What I claim is,—First—the combination and arrangement of signal disks or lanterns, in the manner and for the purpose set forth. Secondly—I claim the method of signalizing the alphabet by means of a decimal progression. Thirdly—the system of flags described, that is to say, the combination of numeral and decimal or denominator flags, combined and applied in the manner specified."

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41. For an improvement in the *Ring Groove Spinner;* John Thorp, North Wrentham, Norfolk county, Massachusetts, September 27.

This is for an improvement on the well known ring groove spinner, patented many years ago by Mr. Thorp, and consists of a ring made of round wire let into a hole made in a plate of iron; on this ring is fitted the wire hook which is carried around with the thread in spinning, and for the purpose of putting this hook on the ring a small hole is made in the plate by the side of the ring, and a portion of the outer periphery of the ring, the hole being somewhat larger than the diameter of the wire of which the hook is made.

Claim.—"What I claim, and desire to secure by letters patent, is an improvement consisting of a new combination of ring, hole, and hook, adjusted to the plate of the ring flyer, and in combination with each other, the ring, hole, and hook, forming, by the peculiar construction and adjustment of each, and by their combination as in the specification, an improvement of the ring flyer, and which is called the universal ring flyer."

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42. For an improvement in the *Bark Mill, for Grinding Tanners' Bark;* Mather Beecher, Remson, Oneida county, New York, September 27.

In this mill the concentric rings of the runner work between those of the fixed or bed grinder; the teeth being formed on the inner and outer peripheries of the rings, and the upper edges armed with cutters, to cut the bark into large pieces before the grinders begin to act.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the addition of the hook extending above the edges of the rings of the grinder, and presenting their point forward in the direction of the motion of the grinder. The whole being arranged, constructed, and combined substantially as described."

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43. For improvements in machinery for *Pulverizing Clay and making Bricks;* Nathan Sawyer, Baltimore, Md., September 27.

The clay is pulverized by means of a vertical wheel with the two faces armed with circular rows of teeth; the sides of the box (called cheeks) below the shaft are also provided with corresponding teeth, and at the top of this box there are bars or rods of iron, bent in semicircles, so arranged as to lie between the rows of teeth on the wheel; these are called "guard pieces," and prevent the entrance of stones.

The pulverized clay passes from the pulverizer into a trunk of considerable length, into which a follower works, to force the clay forward to a cutting knife; the condensation of the clay being effected by the resistance occasioned by the sides of the box, which, at the same time forms the ends and sides of the brick, the thickness being formed by a knife which moves up and down, and which, at each stroke, severs a brick from the block or mass of compressed clay forced through the trunk. The trunk is made larger at that end in which the follower works than it is where the bricks are formed, and the intermediate space slopes regularly to condense the clay. To a sliding gate, immediately in front of the end of the trunk, there are two knives attached, one to pare off the end of the mass of clay to form one face of the brick, and the other to sever or separate the brick from the mass.

Claim.—"What I claim is the manner of condensing the pulverized earth or clay, by forcing it by means of a piston, through a channel like that which I have denominated a moulding trunk, which trunk may be made to vary in the dimensions of its respective parts, in the manner set forth, or may be of the same dimensions throughout, but of increased length; it being so made, in either case, as that the friction of the clay against the sides of the channel along which it must pass, shall suffice to cause the material to be sufficiently condensed to give the required solidity to the brick.

"I likewise claim the cutting off and paring the sides of the brick by means of knives, arranged and operating substantially as set forth. I also claim the particular manner of constructing the pulverizer, by combining a revolving disk, furnished with teeth on each of its faces, with the guard bars and the cheeks, as set forth."

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44. For an improvement in the *Hand Printing Press;* Seth Adams, Boston, Mass., September 27.

The following claim is deemed sufficient to enable the reader to understand the character of the improvement.

Claim.—"I claim my particular mode of arranging and operating the bed, (with or without its form of type) platen, frisket frame, (with or without its frisket) and inking apparatus, with respect to each other; not meaning in the above to claim the mechanical devices adapted to produce their respective movements, but the manner in which they are all arranged and operate together, or in combination with each other, the said arrangement and operation of the parts consisting, first, in placing the platen in line between the bed and frisket frame, (when the frisket frame is out or in the position to receive a sheet of paper to be printed) and somewhat above the same; secondly, in causing the bed and frisket frame to be moved towards each other and the platen and beneath the platen, and so as to carry the frisket (containing the sheet of paper) directly under the platen and over the form of type on the bed—and, after imprinting the sheet of paper, reversing the movement of the bed and frisket frame, so as to cause them to recede from each other and the platen, and to come in their first position, viz:—such a position as will enable the operative or operatives of the press to remove the printed sheet of paper and supply its place with one to be printed; and thirdly, in disposing the inking apparatus directly in rear of, or upon the rear part of the platen, and so that as the bed passes out from beneath the platen, and in or below the same, the said inking apparatus shall ink the form of type, as set forth.

"I also claim the combination of levers, connecting rods and links in their application to the bed and frisket frame, in the manner as set forth, and for the purpose of producing the required movements of the frisket frame through those of the frame. I also claim the manner by which I am enabled to produce the reciprocating, rectilinear, lateral movements of the distributors upon the roller beneath them, without using any apparatus such as is generally applied to the said lateral distributors for changing their angular positions with respect to the roller beneath them, so as to cause them to travel upon it from one end of it to the other end, in an opposite direction, viz: by arranging the main distributing rollers with respect to the roller by which the type is inked, and the said inking roller with respect to the bed, as described; the peculiar back and forth motions of the lateral distributors from end to end of the roller—which has never been so effected in any printing machine which has ever come to my knowledge."

Patent Re-issued in the month of September, 1844.

1. For an improvement in the mode of *supplying Steam Boilers, and in the manner of operating the valves of Steam Engines;* Henry R. Worthington, New York City, September 7.

This patent was originally granted on the 24th of July, 1844, and noticed in this journal, vol. ix, third series, page 178, to which the reader is referred for a description of the apparatus.

Claim.—"What I claim, is the employment of a spring in combination with the steam valve of an auxiliary engine, for supplying a boiler with water, so arranged, substantially as described, as to admit of its being properly armed or compressed by the action of the engine upon an intermediate piece, or lever, while the steam valve remains at rest, until, at the proper time, by the farther motion of the engine, the spring is released, and also to draw said valve independently of the momentum of the engine, in the manner and for the purpose above fully set forth."

List of American Patents which issued in the month of November, 1841, *with Remarks and Exemplifications. By* CHARLES M. KELLER, *Examiner of Patents.*

(Continued from Page 258.)

24. For a machine for *Cutting Crackers;* William R. Nevins, New York city, New York, November 10.

The cutters are attached to the faces of a rotating polygon. The dough is rolled between two rollers and then passes between the lower of these two rollers and the cutters which form the crackers that are carried around and deposited on an endless belt, by means of a follower in each mould which forces the crackers out, this is effected by bolts to which the followers are attached, and which are surrounded by spiral and bow springs to keep the follower drawn in against the bottom of the mould until they come around to that part of the circuit at which the crackers are to be discharged, at which time the heads of the bolts are brought against springs projecting in manner similar to cams from a cylinder within the polygon of cutters.

Claim.—"What I claim is,—First—the arrangement of the cutters on a polygonal drum; Second—the spiral springs in combination with the bolts, and the manner in which they are intercepted by the springs; the whole combined substantially as set forth."

25. For an improvement in the *Pump;* Joel Farnham, Stillwater, Saratoga county, New York, November 10.

Claim.—"What I claim, is the before described construction of the box bolted to the bottom of the cylinder, and side trunk and cap, for simplifying and reducing the expense of the pump and its liability to get out of order, as set forth—that is to say, making a single solid cast iron box, divided into three chambers by a transverse partition, forming a receiving chamber, and a longitudinal partition extending from said transverse partition to one end of the box forming the two discharging chambers having the top perforated with six apertures, two over the first mentioned chamber, and two over each of the other chambers, and having the bottom perforated with a single aperture leading to the receiving chamber for the admission of the water to the said chamber, doing away with the lower or under cups, and valve, plates and valves, and the necessary packing, and bolts for securing the same, in the manner and for the purpose set forth."

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26. For an improvement in the machine for *Cutting Shingles:* Lloyd White, Jeffersonville, Clarke county, Indiana, November 10.

"I am aware," says the patentee, "that shingle machines have been made with two knives so arranged as to approach each other in shaving the shingle from the butt to the point, but in such cases the block moves up towards the knives, which have no other motion than towards each other while the taper is being formed, and therefore I do not wish to be understood as making claim to the employment of two knives that approach each other in cutting from the butt towards the point. But what I do claim as my invention and desire to secure by letters patent, is the combination of the two plates, or gates, with the knives attached to them and working in slides which approach each other towards the bottom, for the purpose and in the manner described."

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27. For an improvement in the construction of *Bridges;* Josiah Rogers, New York city, New York, November 10.

Claim.—"What I claim, is the constructing of a cylindrical bridge, either of wood, or iron, by the combining together of circular ribs, string pieces, and diagonal braces, which braces consist of continuous strips of wood, or of iron, surrounding the ribs and string pieces, and passing spirally in reversed directions from end to end of the bridge, thus constituting a braced lattice work on the exterior of the cylinder. The whole being constructed, arranged, and combined substantially in the manner set forth.

"I also claim, in combination with such a cylinder bridge, the forming of a rectangular passage way, having its vertical sides, or a vertical partition, constructed, arranged, and combined substantially as made known."

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28. For an improvement in the *Tuyere for Blacksmiths' Forges;* Joseph Lauback, Middletown, Dauphin county, Pennsylvania, November 10.

A vertical hollow cylinder with a basined rim at the top and a valve at the bottom, is let into the hearth, the basined part at top being made to receive the coals, and the valve at the bottom for the discharge of the cinders which may fall through. Instead of a grate for the hearth, there is a triangular piece of cast iron on a shaft placed in the upper part of the cylinder, the shaft being provided with a crank handle for turning or vibrating it, and the edges notched for the passage of the blast from a bellows, the nozzle of which is introduced near the bottom of the cylinder.

Claim.—"What I claim, is constructing the blacksmith's forge with a revolving or vibrating hearth in the manner and for the purpose set forth, and in combination therewith the cylinder with the basined rim forming part of the hearth and having a tube to receive the nozzle of the bellows, said cylinder receiving the blast from the bellows, and serving as a receiver for the small cinders, as described."

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29. For an improvement in *Water Backs for Forges;* William McEwen, Norristown, Montgomery county, Pennsylvania, November 10.

The improvement "consists in so constructing it that the cast iron box, or tank, which contains the water, and the fire end of which constitutes the forge back, shall project into the body of the forge to a distance beyond the wall, or stack, which constitutes the brick work, or masonry thereof, so that the blast shall issue from the nozzle, or tuyere, in advance of the ordinary forge back; by which improvement it is specially adapted to the heating of wide bars or other large masses of iron."

Claim.—"What I claim, is the forming of the box, or tank, with a projection, or offset, so as to cause the blast from the bellows to escape from the nozzle, or tuyere, in advance of the line of the ordinary forge back, in the manner and for the purpose set forth."

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30. For an improvement in *Suction, Lifting, and Force Pumps;* Chapman Warner, Lexington, Fayette county, Kentucky, November 10.

This "consists in combining two vertical cylinders of unequal diameters, the smaller one arranged above the larger one, at a short distance therefrom, leaving their axes coincident with an air chamber of greater diameter than the lower cylinder, formed on the upper end of said lower cylinder and surrounding the upper cylinder, whose flanch forms the top thereof, covering the space between the outside small cylinder, and the inside of the air cylinder with a spout passing down through said flanch to near the bottom of the air chamber, having two pistons on a single piston rod, moved by a connecting rod and lever, one of which pistons is solid and moves in the upper, or small, cylinder, for forcing, and the other, which works in the lower, or large, cylinder, is perforated for the passage of the water through the same, is for lifting the water, and also for forming a vacuum in the larger cylinder into which the water rises through a lower valve on the bottom of said large cylinder, and also at the top of the pipe leading to the well of water."

Claim.—"What I claim, is the manner of combining the two cylinders of unequal size with an air chamber having a spout so as to produce, by means of two pistons, arranged as set forth, an equal discharge of water at the upward and downward stroke, or nearly so, substantially as described."

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31. For a *Pressure closing Stop Cock for Conduit Pipes;* Horatio Allen, New York, November 12.

A chamber is formed in the pipe, "of dimensions proportionate to the area of passage which the cock is to provide; on the inner surface of this chamber is a projection, or shoulder, of a depth sufficient to afford an adequate lap and seat to the valve which is to close against it." The plate which is to close against it is jointed to an arm projecting from a shaft which passes to the outside of the pipe or chamber, and there provided with a hand lever for opening or closing the valve, and this lever is acted upon by a spring to assist in opening or closing the valve and retaining it in place. By this arrangement the valve is kept to its seat by the pressure of the water acting against it.

Claim.—"What I claim, is, first, the combination of a suitable seat, formed in the inside of a pipe or of a chamber to be placed in the line of the pipe, with a plate or valve closing with the pressure against said seat, the plate or valve being carried by an arm attached to a shaft which is worked by a handle outside the chamber; secondly, the combination of a spring with the handle outside the chamber, either acting with the pressure of the contained fluid to close the valve when the pressure is very light, or acting against the pressure if the contained fluid is very great."

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32. For an improvement in *Spectacles;* Christopher H. Smith, Niagara Falls, Niagara county, N. Y., November 12.

The bows of these spectacles are without glasses, and to the main frame are attached, by swivel joints, two sets of different kinds of glasses; either or both of which can be brought to cover the open apertures or bows, and by means of the swivel joint, the glasses can be turned so as to have either set let into the bows, and the other at the sides or over them, and thus the colors or focal powers may be changed at pleasure.

Claim.—"What I claim as my invention, is combining the glasses with each other and with the main frame, by means of the hinge and swivel joint arrangement described, which admits of the glasses being changed, and at the same time adapted to the vacant apertures, all as set forth."

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33. For an improvement in the manner of *arranging the screw, or spiral, propeller for Steam Ships or other vessels;* Francis Pettit Smith, London, England, November 12, to run fourteen years from the 31st of May, 1836, the date of the English patent.

Claim.—"What I claim as my invention, is the arranging, or placing, of a screw propeller in the dead wood, or dead rising, of a vessel, the thread of which screw shall make one entire revolution, or nearly so, upon its shaft, which thread may be in one continuous piece, or it may be divided into two parts, each making one half turn, or revolution, round the shaft, or be otherwise modified whilst it is made to operate in the dead wood substantially in the manner fully made known."

34. For improvements in the *Cooking Range;* Abiram Spaulding, New York City, November 12.

We are under the necessity of omitting the claim, as it refers throughout to, and is wholly dependent upon, the drawings, which are very numerous, and necessary to a clear exemplification of the improvements claimed.

35. For a *combined Dumb and Parlor Stove;* Alonzo L. Blanchard, Albany, N. Y., November 12.

The leading characteristic of this stove is fully expressed in the following

Claim.—"What I claim, is the manner of combining with each other, a statue or other ornamental device, and a pedestal, divided into compartments, substantially in the manner set forth, so that they shall constitute a dumb stove, within which the heated air from a fire below shall circulate through the respective chambers, and through the body of the statue or other ornamental device placed upon the pedestal, as set forth. I claim, also, the combining with such a stove, a fire chamber, by means of which it may be converted into a parlor stove; said combination being formed by arranging the respective openings, chambers, and dampers, substantially in the manner made known. I claim, likewise, the particular manner of hanging the door of my parlor stove with concealed hinges, as described. And lastly, I claim the manner of supplying the draught to the fire chamber through a trunk, or hollow case, located and arranged as described."

36. For an improved *apparatus for making Bedsteads;* Thos. Cole, Greensburg, Decatur county, Ia., November 12.

This apparatus consists of a box, into which, the rails of bedsteads are secured and held by wedges and screws, and provided with guides for directing the saws in cutting the tenons, and the bits in boring the holes, without shifting the rails.

"What I claim is the particular manner of combining and arranging the respective parts of the box for receiving the rails, and for cutting the tenons thereon, and for boring the requisite holes therein, without shifting said rails during the operation; the whole being constructed and operated substantially as set forth."

37. For an *open Grate or Parlor Stove for Anthracite Coal;* Otis Jenks, Albany, N. Y., November 16.

The claim in this patent refers throughout to the drawings, and without them, a clear notion of the structure and arrangement could not be given; and as, from their complexity, their insertion would carry us beyond our limits, we are under the necessity of omitting all farther notice.

38. For an improvement in the *Lamp for burning Lard and other concrete fatty matter;* Norman S. Cate, Charlestown, Mass., and James H. Putnam, Malden, Mass., November 16.

The burner of this lamp consists of two flat wick tubes, with a metallic conductor between them, and held in a spring clasp, and provided with teeth or cogs on one edge, into which, the teeth of a pinion take, to move it up and down, and thus regulate its position relatively to the height of the wicks.

Claim.—"I shall claim the movable metallic conductor situated between the wick tubes, and arranged in the spring collar, as described, so as to be elevated or depressed, or adjusted to any desirable position with respect to the flame; the same being constructed and operating substantially in the manner set forth."

39. For an improvement in the *Life Preserver;* Napoleon Edward Guerin, New York City, November 16.

Claim.—"What I claim as my invention, is the introduction of rasped or grated cork into any garment, as a life preserver."

40. For an improvement in *Elliptical Carriage Springs;* David E. Edwards, Boston, Mass., November 16.

Claim.—"I shall not confine myself to the method described of confining the ends of the plates, but I claim as novel and of my invention, inserting between the main lower and upper plates of an elliptic spring, a double curved spring, or one forged into the shape of an oge curve, or approaching to that of the letter S, so as to divide it into two springs and increase its rigidity, at the same time superseding the use of most, if not all the ordinary back plates; the whole being substantially as above described."

41. For a mode of *securing Metallic Shanks in Glass Knobs;* John G. Hotchkiss, J. A. Davenport and John W. Quincy, New York City, November 16.

"In forming the knobs of glass, whether by blowing or by pressure, a cavity is left in the back part of the knob where the neck, shank, or screw is to be fastened; such cavity being so made as that by means of a fusible metal or alloy, poured into it, the neck, shank, screw, or other article prepared for the purpose, shall be securely held in place."

Claim.—"What we claim, is the securing of shanks, screws, &c., within knobs of glass, by means of a fusible metal or alloy, substantially in the manner made known."

BIBLIOGRAPHICAL NOTICE.

American Quarterly Journal of Agriculture and Science; conducted by Dr. E. Emmons and Dr. A. J. Prime. Albany, New York: Price, $3 per annum.

Among the novelties of the day, we find upon our table, the first number of a new quarterly Journal intended to be principally devoted to the interests of Agriculture, under the title "American Quarterly Journal of Agriculture and Science; conducted by Dr. E. Emmons and Dr. A. J. Prime, Albany."

Heartily do we rejoice in the appearance of this new journal and earnestly do we desire to see it as eminently successful as it deserves, believing, as we do, that to no country has Providence given greater facilities for agricultural improvements and no where have these advantages been more entirely neglected or abused. We think, however, that we have been able, of late, to see the awakening effects of the numerous journals which have already devoted themselves to this subject—and we hail the appearance of a new and powerful auxiliary in this indispensable improvement. The number now before us, gives great promise of an unusually high degree of excellence; its principles, as announced in the address to the public, must, if adhered to, render it of inestimable value to our farmers; and we are peculiarly gratified to find the distinction at once drawn between the cropping fitted for our soil and climate and that suited to the vastly different circumstances which occur in Europe. The original articles are of interest, as well to the man who wishes to keep up with the progress of information as to the practical farmer. The chemical investigations of our American plants, we look upon as of very great importance, and hope that the journal may be made a medium for giving to the public similar analyses of our own soils by our own chemists. The foreign selections are judicious. In fine, we regard the appearance of this journal as of vast importance to our Agricultural interests, and hope that it will be encouraged as it should be, by our farmers throughout the country. Com. Pub.

MECHANICS, PHYSICS, AND CHEMISTRY.

On a Theoretical Rule for the Compression of Water, By Daniel MacKain, M. Inst. C. E.

[Read before the Glasgow Philosophical Society.]

The extreme elasticity of air, when considered with reference both to the amount of force which we can apply to it, capable of producing important changes in its volume, without any great effort, and to the strength of the materials of which the instruments used for ascertaining its compressibility, are composed, have enabled philosophers to determine with considerable accuracy the ratio which it obtains between the force applied and the resulting condensation of volume.

A considerable time ago it was believed that the compressibility of air was in proportion to the pressure applied; this was subsequently proved nearly 200 years ago, by Boyle, and also by Mariotte about 50 years afterwards; and this law of compression has since been known by the name of the latter. More recently Messrs. Dulong and Arago have confirmed the accuracy of the law of Mariotte, by experiments conducted to the range of no less than 27 atmospheres beyond the common atmospheric pressure. *

By means of the barometer, the density of air is found to vary according to its mass superincumbent over any given point in the atmosphere, and the numerous experiments made with this instrument, have brought to such a degree of accuracy the barometrical measurements of parts of the earth's surface protruding into the air, as to vie with measurements of their heights made by trigonometrical instruments. These degrees of density are measured by a column of mercury, and, consequently, the height of the column indicates the force of compression, and represents the height of the superincumbent mass of air.

The extent of compression which water undergoes, when subjected to force has engaged the attention of men of science for some time back. In 1762, Mr. Canton found that the addition to, or subtraction from water, of a weight equivalent to that of the atmosphere, produced at the temperature of 60° a contraction or extension of rain water of 4 millionth † part of its bulk, and of sea water at 40 millionth parts, while in mercury it only amounted to 3 millionth parts: showing that the density of the fluid operated on materially affected the results. Thus, in the case of rain water, a force equal to a column of itself 33⅓ feet in height produced a contraction of 46 millionth parts: of sea water, a column 32 feet in height produced a contraction of 40 millionth parts: and in mercury, a corresponding column of 2½ feet produced 3 millionth parts of compression. Professor Zimmerman of Brunswick, Professor Œrsted of Copenhagen, the late Sir John Leslie of Edinburgh, and Mr. Perkins, have made numerous experiments that establish the fact of compression ascertained by Mr. Canton, which, at the time his experiments were published, was at variance with the opinions universally entertained on this subject. With the usual haste with which Sir John Leslie speculated on experimental results, he arrived at the conclusion "that the ocean may rest on a subaqueous bed of air," from the apparently greater degree of condensation which force can produce in air, in contrast with that which similar forces were supposed capable of producing on water.

The degree of compression of water, is, however, extremely small:

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* This law has been recently extended by M. Aime to a pressure of 220 atmospheres. The full account of his beautiful and ingenious experiments will be found in Annales de Chimie, 3d series, tom. VIII, (1843) page 257.

It is evident that the author of the present article is unaware of these experiments, as well as the previous ones of Sturm and Colladom.—Com. Pub.

† For 4 millionth, read 46 millionth.

and the force which it is necessary to apply to it, in order to produce any appreciable degree of diminution in volume, is so great in proportion to the limit of rigidity of the materials used in experimental apparatus, that there is much room for doubt, as to whether or not the indications heretofore recorded, be not compound measures of the elasticity of water, and of the materials of which the instruments have been formed.

It has occurred to me, that if the results of the experiments were noted, in which great bulks of water were employed, but operated upon by slight forces, that a degree of compression might be ascertained, sufficient to remove much of the doubt that may at present be entertained as to the rigid accuracy of the experiments on which our ideas of the elasticity of water are at present based—further, that, in these experiments, should any analogy be discovered between the ascertained laws which govern the compression of air, and the comparative indications of compression of water, we may take the laws which repeated experiments have proved to govern the compression of air, as analogous rules for the compression of water; and, calculating from them, may compare the theoretical results which the laws would furnish, with similar conditions ascertained by experiment.

Following out this idea, it appears probable that the transmission of water and gas through long ranges of pipes, may, by the comparative forces required to propel given quantities through them, give an approximate rule for estimating their compressibility; for, if water were totally incompressible, there would undoubtedly be some difference between the quantities of air or gas transmitted through a pipe, and that of water by a corresponding force through a similar pipe—the one would accumulate in density according to the force required for its propulsion; while the movement of the other would be like a bar of iron, influenced only by friction.

In the transmission of water through long ranges of pipes, it has been ascertained that the quantity discharged by a pipe of any given diameter in length, is inversely in proportion to the square root of the length—and directly proportional to the square root of the height of the column of water employed to propel it.

The comparatively recent adaptation of carburetted hydrogen gas, for the purpose of lighting towns, has required attention to the laws by which it is conveyed through pipes. Gas is usually forced through pipes, by employing a slight column of water, of a height sufficient to propel the required volume with the velocity required. Now, as already mentioned, the laws of compression of gases and air *have been exactly ascertained;* and it is thence evident, that even the slight compressing force usually employed for the transmission of gas, must produce an alteration in its bulk, at the place where the motion originates.

The most exact observations made as to the laws by which gas is conveyed through pipes, show that in like manner as water, the quantity which a pipe can discharge, is inversely proportional to the square root of the length of the pipe, and directly proportional to the square root of the force employed to propel it. As gas, after having been propelled through a range of pipe, and when escaping from its extremity into the air, will be only of the density due to the pressure of the atmosphere, the proportion of it at the origin of the pipe, or, as is usual in practice, that in the gas-holder, is not only of the density of the atmosphere, but is also of that further degree of compression due to the force applied for its propulsion through the pipes. In all experiments made with pressure-gauges along various lengths of pipes, this extra degree of compression is found to diminish according to the square root of the length of the pipe, thus showing a gradual relaxation of compression, and a steady progression of current.

The ascertained laws of impulsion and of retardation of gas and water being thus exactly alike, it now only remains to ascertain their measure; and if these be found proportional to their density, there appears reason to believe, that water, under proportional forces, is as compressible as air.

I shall endeavour to support these views by the following facts and deduction from them:—

As water is 825 times heavier than air, the velocity communicable to air contained in a pipe by the pressure of one vertical inch of water is equal to that of 825 vertical inches, or 68 feet of air; and if gases be referred to, as their specific gravity is usually compared with that of air as 1, the height of a corresponding column of any gas equal to 68 feet divided by the specific gravity of that gas; thus, one inch of water is equal to $\frac{68}{500} = 12$ feet of gas, specific gravity .560.

In the Hydrodynamie * of Bossut, he states as the result of experiment, that an aperture of one inch in diameter, under the pressure of a column of water 10 feet in height, discharged 8574 cubic inches, or 4.96 cubic feet of water per minute.

By an experiment made at the Leith Gas Works, a hole, one inch in diameter, under the pressure of one vertical inch of water, discharged 17.7 cubic feet of gas, specific gravity 560, in the same time.

Now, comparing these discharges by the square roots of their respective impelling columns, we have

Water, Gas,

$$\sqrt{10} \text{ feet} : 4.96 :: \sqrt{122} \text{ feet} : 17.33,$$

instead of, as above, the actual discharge 17.70.

Again, Bossut reports, that a hole 2 inches in diameter, with a pressure of 11 feet 8 inches and ten lines of water ,discharged 13.021 cubic inches of water in 21 seconds, or at the rate of 25.52 cubic feet per minute.

It was also found at Leith, that a hole 2 inches in diameter, with a pressure of one inch of water, discharged 69.5 cubic feet of gas, specific gravity .560, per minute.

Reducing the fractions of Bossut's pressure to decimals of a foot, and resolving the pressure into columns of the respective substances we have the proportionate discharge due to these columns:—

Water, Gas,

$$\text{as } \sqrt{11.736} \text{ feet} : 22.152 :: \sqrt{122} : 69.41$$

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* For Hydrodynamie, read Hydrodynamique.

cubic feet, which may be reckoned to be identical with the result brought out by experiment.

The Abbé Bossut found by experiment, conducted with great care, that a pipe, 2 inches in diameter, 150 feet long, with the pressure of a column of water 2 feet in height, discharged 5.232 cubic inches, or 3.0278 cubic feet of water per minute.

I have been favored by the results of two experiments made with pipes of 2 inches in diameter, and 150 feet long, which, with a pressure of one vertical inch of water, discharged 22.66 cubic feet of gas, sp. gr. .560, and with 2 inches of water 35.16 cubic feet.

In contrasting these experiments, it is to be remarked that the pipes are of the same diameter and of the same length, consequently, the only correction necessary is that due to the variation in the height of their respective impelling columns. Thus, as before, the experiment with one inch of water—

Water, Gas,
as $\sqrt{2}$ feet : 3.0278 : so is $\sqrt{122}$ feet : 23.647,

the actual discharge with one inch being 22.66; and that of 2 inches of water—

Water, Gas,
as $\sqrt{2}$: 3.0278, so is $\sqrt{244}$ feet to 33.443

cubic feet—the actual discharge as above having been 35.16.

In 1819, M. Gerard made various experiments with gas apparatus constructed for lighting the Hospital of St. Louis, at Paris, to ascertain the discharges of gas and air through pipes at the distances of 402½, 1233, and 2043 feet respectively from the gasometer,—the discharges of air with a pressure of 0.858 of an inch of water were 30.205, 18.150, and 13.237 cubic feet per minute.

Not having any direct experiments with water made under precisely the same conditions, I shall only apply the hydraulic formula of Debaut, to show the similarity of discharges of that fluid under the same circumstances.

0.858 of an inch of water is equal to 58.334 feet of air—with this head the discharge of water by the same pipe, about the distances above stated, would be 36.206, 21.598, and 14.015 cubic feet.

The close approximation of these results will, I hope, be a sufficient warrant to me for having brought forward the subject with a view to provoke further inquiry; whether the calculation I have entered on, or the deductions drawn from them, be correct or not.

I shall now proceed to compare the rates of compression under this theory, with those indicated by experiment.

Air is found to be compressed into one half its bulk by the addition of a weight equal to that of the atmosphere, or the addition of a force equal to 28330 feet of air. In the same proportions between gas and water indicated by the impelling and retarding forces in a long train of pipes, water should also be compressed into one-half its bulk, by the addition of a force equivalent to a column of itself, 28330 feet or 5.36 miles.

Professor Leslie estimates that it will be only compressed to this degree at the depth of 93 miles.

It has already been mentioned that Mr. Canton had indications which represented the contraction of pure water at 46 million parts, and sea water as 40 million parts, by the addition of a force equal to the weight of the atmosphere. By the rule of compression followed in this paper, pure water would compress 11.65 parts, and sea water 11.55 parts in a million, with the pressure due to an atmosphere of air.

Zimmerman arrived at the conclusion that sea water compresses $\frac{1}{340}$ part, when under the pressure of 1000 feet of its own body.—The present theory indicates that it would contract very nearly $\frac{12}{340}$ parts under the same pressure.

Professor Œrsted's apparatus, judging from the engraving in the Transactions of the British Association, seems to have been incapable of measuring with accuracy the forces stated to have been used.

In 1826, Mr. Perkins laid before the Royal Society a table of compression of water, derived from experiment, in which he states that of a column of 190 inches of water to have been for

		Parts.
10	atmospheres	0.176
100	do.	1.385
200	do.	2.395
500	do.	5.010
700	do.	6.961
1000	do.	8.855

while by the theory now advanced these compressions would have been

		Parts.
10	atmospheres	2.1
100	do.	20.0
200	do.	36.2
500	do.	70.4
700	do.	89.1
1000	do.	102.7

I cannot avoid alluding to a slight though rude corroboration of the theory now advanced—the belief of seamen in the greater density of water at great depths than is generally admitted. They find a great difficulty in sounding in deep water, except with very heavy leads. From the increased weight of the leads required, and from the diminished effect on the hand when sounding, seamen are almost universally impressed with the idea that the loss of effect is produced by the increased density of the water.

I shall only add, that if water be compressible to the degree I have now advanced, and the substances now stated were incompressible, bricks will float at a depth of 28,330 feet; granite at 56,600 feet, or 10 miles; and cast iron at 200,000 feet or 39 miles.

Glasgow Prac. Mech. and Eng. Mag.

Description of a simple method of Magnetizing Steel Bars. By P. Elias, of Haarlem.

At the present day, when the possession of powerful steel magnets must be desirable to experimentalists, it will perhaps not be without interest to many to become acquainted with the method by which the smallest needle, as well as the heaviest steel bar, can be instantly magnetized to saturation with the greatest facility.

The method hitherto employed is that of the double passing, discovered by Knight, and improved by Duhamel and Mitchell. Several persons have proposed the employment of electro-magnets for this purpose, others suspending the steel bar to be magnetized at a red heat to the pole of an electro-magnet, and allowing it to cool in that position. The first method is inconvenient, as it is not possible to move electro-magnets about so freely as steel magnets; the latter, as every one knows, is without effect, consequently, the old method has been retained. This, however, has the inconvenience, that in the first place, it is necessary to be well acquainted with the manipulation of magnetizing; and secondly, that you must already possess that which is to be made, viz., highly powerful magnets, which is rarely the case.

With my method I require nothing more than what every experimentalist possesses, and may be had every where, a powerful voltaic pair, and some copper wire. From twenty-two to twenty-five feet of well isolated copper wire are wound round to form a hollow, very short, but very thick, cylinder. A strong current is passed through the wire, and the steel bar to be magnetized is placed in the cylinder, in which it is moved up and down to the very ends. When the central portion of the steel bar again occupies the cylinder, the circuit is opened, and the bar, which is now perfectly magnetized, withdrawn. When the bar is curved in the form of a horse-shoe, it is well to close it with its keeper during the magnetizing, and when a straight one, to provide it at top and bottom with a piece of soft iron. The wire which I employ is one-eighth of an inch in thickness. The thickness of the wire is not at all indifferent; the same effect it is true may be produced with a thinner one, but then it requires a battery of greater intensity. The voltaic apparatus which I make use of is a single platinum and zinc pair arranged on Grove's principle; it has one-third square foot active platinum surface; the resistance which the current meets with in this battery is equal to that of a clean copper wire, one millimetre in diameter, and two-thirds of a metre in length.* The experiments, however, succeed perfectly well, even when the battery presents a twice or three times greater resistance. My hollow cylinder is one inch high, the bore is nearly one and a half inch in diameter, and its sides likewise one and a half inch thick.

To test the efficiency of my magnetizing cylinder, a friend of mine had a steel horse-shoe made, weighing thirty-four pounds, of one piece. It was magnetized to saturation by one single passage through a cylinder constructed purposely for this experiment; and a second magnet, after having been placed reversed in the cylinder, proved sufficient to change the poles without having lost its suspending power. Besides the facility and rapidity of this method, it has moreover the advantage, that a bar magnetized in this manner cannot possibly have intermediate poles; and if it previously had possessed any they disappear instantly in the magnetizing cylinder.

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* Since in Grove's battery the smallness of the resistance depends not merely on the size of the metallic surface, but likewise considerably on the goodness of the porous earthen cell, which cannot be determined, I have conceived it to be possible to indicate the power of the battery independent of the resistance only in this manner.

This mode is nothing more than the double passing of Duhamel, or Mitchell, only by means of galvanism, and far more powerful, easy, and certain. As in the double passing the opposite poles of the magnet employed must be kept close together, so as to exert successively their greatest action upon each small part of the bar to be magnetized, in like manner I make my cylinder quite short, that each portion of the bar may experience the entire force of the voltaic element.

My friend Dr. Munnich publicly repeated my experiments with the magnetizing cylinder at a meeting of the Utrecht Society of Naturalists, and the Faculty of the Physical Sciences, which was present, was convinced of the efficiency of the method. On this occasion he increased considerably the intensity of some very powerful bars belonging to the collection, which had been magnetized by Knight himself, and reversed their poles by a single passage, &c.

Lond. Edin. and Dub. Philos. Mag.

Acetate of Iron as a remedy for Arsenical Preparations.

The hydrated peroxide of iron is of admitted efficacy in cases of poisoning with uncombined arsenious, or arsenic acid; but according to the experiments of Duflos, it is quite ineffectual when these acids are combined with bases, as, for example, Fowler's solution, or arsenite of potash, or arseniate of potash, which last is frequently employed in calico printing, and is, consequently, easily procured.

In the uncertainty in which the practitioner may be placed as to whether the arsenical poison be free, or combined, it is very important to administer the oxide of iron in such a form as to produce a favorable result; to this end it is convenient to employ the peracetate of iron.

This compound may be prepared by adding to the hydrated peroxide of iron obtained from the decomposition of four parts of liquid perchloride of iron, three parts of acetic acid of density 1.06, and sufficient water to make up 16 parts.

This liquid, which is a solution of peracetate of iron with excess of base, precipitates arsenious and arsenic acid from all their solutions, either free, or combined with any base; 500 grains of it are sufficient to decompose 1880 grains of Fowler's solution.

This result demonstrates that liquid peracetate of iron merits preference in cases of poisoning by arsenical compounds. It should be remembered that its power is more rapid in proportion as it is more diluted with water; besides which, large dilution prevents all irritating action of the acetic acid set free.—*Journ. de Ch. Méd.*, Novembre, 1844.

[The mode of preparing the above compound is not very clearly stated, for the strength of the liquid perchloride of iron is not given. It may be presumed that peracetate of iron mixed with peroxide is to be employed; the degree of excess of the latter is of little consequence, and the strength of the peracetate is limited by the employment of four parts of acetic acid of 1.06 made up to 16 parts with water, and this, it appears, is to be largely diluted before exhibited.—EDITOR.] Ibid.

Color in Carpets.

SIR DAVID BREWSTER stated that he and Professor Wheatstone had brought to York separate communications on this experiment, with specimens of the rug-work in which it is best exhibited. Having seen Prof. Wheatstone's specimens, he had been induced to limit his communications to a few observations on Prof. Wheatstone's paper, When Sir D. Brewster came to York, he was not aware of the phenomena taking place with any other color but *red* and *green.* Prof. Wheatstone had, however, shown him that *red* and *blue* answered equally well; and he had received letters from two ladies in Scotland, who had not only found that *red* and *blue* exhibited the phenomena, but had both given the probable explanation of their doing so, by ascribing it to the *blue* becoming *green* in the *yellow* light of the candle.

In order to give an explanation of what has been called by some the *fluttering hearts*, from one of the colors having the shape of hearts, Sir D. Brewster mentioned an experiment for the purpose of showing, that any fixed oblect will appear to move on the ground upon which it is fixed, when the light which illuminates it is constantly changing its position and intensity. This experiment consists in moving a candle rapidly in all directions, in front of a statue. The varying lights and shadows produce varying expressions, which give the appearance of life and motion in the features of the statue. Now, in the case of the vibrating hearts, the mixture of the *red* and *green*, whether seen as direct or as accidental impressions, produces successions of light and shadow which give the appearance of motion to the figure upon the *red* or *green* ground. This effect is greatly increased by that remarkable property of oblique vision, in which the retina increases in sensibility as the point impressed is removed from the *foramen centrale.* Hence when we look fixedly at one of the vibrating hearts, it nearly ceases to vibrate, while the others, which are seen obliquely, vibrate with greater distinctness. The phenomenon has been stated to be invisible in daylight; but Sir D. Brewster mentioned that he had, that morning, found that it took place in daylight, provided the colored surface was illuminated from a small hole in the shutter of a dark room. The experiment, indeed, he found to fail even in candle light, if the illumination proceeded from a great number of lights, or from a mass of light producing a *quaquaversus* illumination like that of the sky. He referred also to the effects preduced by colored glasses, and mentioned some facts regarding the unequal absorption of the two colors, which, in drawing conclusions from such experiments, required to be attended to.

Lond. Athenæum.

Elasticity of Rigid Bodies.

Mr. E. Hodgkinson gave an account of some further experiments 'On the defect of Elasticity of Rigid Bodies.' These experiments originated in the suggestion that possibly some of the results which Mr. Hodgkinson had communicated at Cork *(see Athen.* No. 827,) had originated in the friction caused by the supports of the extremities of the bars on which the experiments were performed. He had therefore, in these latter experiments, placed strong friction wheels as supports for the ends of the bars; he had also changed the mode of measuring the deflection. He had previously used a wedge graduated on the side; he substituted for this a fine screw with a divided micrometer head, by which he could measure the 10,000th part of an inch of a deflection. He then gave the numerical details of the sets taken by various bars after they have been loaded and then relieved. The most striking general results were, that the index of the power of the load to which he found the set taken most nearly proportional was 2; that every load, however trivial, caused a set, and that this set did not entirely disappear when the bar was given time to recover its state, but in general diminished greatly.

Dr. Scoresby inquired if Mr. Hodgkinson had tried whether a vibratory motion excited among the particles of the bar would enable them to recover their original arrangement.—Mr. Hodgkinson had not, but promised to attend to the hint.—Dr. Robinson suggested that the vibratory motions should not be excited with violence sufficient to cause mechanical derangement of the particles.—Lord Rosse stated two facts bearing on Mr. Hodgkinson's investigations; one, that the standards which had been made to replace those destroyed by the burning of the House of Commons had been found to alter very slightly but decidedly their dimensions, after having been finished with the greatest care. The other, that cannon were never permitted to be discharged more than 400 times under ordinary circumstances, for after that they were deemed unsafe.—Dr. Robinson stated that a fact which had always appeared very strange to him received a probable explanation from what he had just heard. It was found that the platina standard of a metre which had been constructed under the superintendence of the Academy, and which was a square prism, each of whose four faces, therefore, was entitled to be considered as the standard metre of France, when examined many years afterwards, had no two of its sides of exactly the same length: this was supposed to have arisen from the carelessness of the artist employed in its construction, who had accordingly been much censured. He now deemed it highly probable that it had been originally constructed perfect, but had altered its own form. He also mentioned a case in which the glasses of a telescope having been confined by adjusting screws to their places, to which it was necessary for the perfection of the instrument that they should be brought with extraordinary precision, the images of the fixed stars were found to form a cross of light; and it having occurred to him that the confining screws might, by altering the relative positions of the particles, affect their optical action on the light, it was found upon loosening them, that the irregular image disappeared. Ibid.

On the Liquefaction and Solidification of Bodies generally existing as Gases. By Micheal Faraday, Esq., F. R. S., D. C. L., &c.

The method employed by the author for examining the capability of gases to assume the liquid or solid form, consisted in combining the condensing powers of mechanical compression with that of very considerable depressions of temperature. The first object was obtained by the successive action of two air-pumps; the first having a piston of one inch in diameter, by which the gas to be condensed was forced into the cylinder of the second pump, the diameter of whose piston was only half an inch. The tubes into which the air, thus further condensed, was made to pass, were of green bottle glass, from one-sixth to one-quarter of an inch in external diameter, and had a curvature at one portion of their length adapted to immersion in a cooling mixture: they were provided with suitable stop-cocks, screws, connecting pieces, and terminal caps, all very carefully made, and rendered sufficiently air-tight to retain their gaseous contents under the circumstances of the experiments, and when they were sustaining a pressure of fifty atmospheres, as ascertained by mercurial gauges connected with the apparatus. Cold was applied to the curved portions of the tube by their immersion in a bath of Thilorier's mixture of solid carbonic acid and ether. The degree of cold thus produced, when the mixture was surrounded by the air, estimated by an alcohol thermometer, was a temperature of —106° Fahr. But on placing the mixture under an air-pump, and removing the atmospheric pressure, leaving only that of the vapor of carbonic acid, which amounted only to 1-24th of the former, (that is to the pressure of a column of 1.2 inch of mercury,) the thermometer indicated a temperature of 166° below zero of Fahrenheit's scale. In this state, the ether was very fluid; and the bath could be kept in good order for a quarter of an hour at a time.

The author found that there were many gases which, on being subjected to cold of this extreme intensity, condensed into liquids, even without a greater condensation than that arising from the ordinary atmospheric pressure, and that they could then be preserved, sealed up in glass tubes, in this liquid state. Such was the case with chlorine, cyanogen, ammonia, sulphuretted hydrogen, arseniuretted hydrogen, hydroiodic acid, hydrobromic acid, carbonic acid, and euchlorine.

With respect to some other gases, such as nitric oxide, fluosilicon, and olefiant gas, it was difficult to retain them for any length of time in the tubes, in consequence of the chemical action they exerted on the cements used in the joinings of caps and other parts of the apparatus. Hydroiodic and hydrobromic acids could be obtained either in the solid or liquid state. Muriatic acid gas did not freeze at the lowest temperature to which it could be subjected. Sulphurous acid froze into transparent and colorless crystals, of greater specific gravity than the liquid out of which they were formed. Sulphuretted hydrogen solidified in masses of confused crystals of a white color, at a temperature of —122° Fahr. Euchlorine was easily converted from the gaseous state into a solid crystaline body, which, by a slight increase of temperature, melted into an orange-red fluid. Nitrous oxide was obtained solid at the temperature of the carbonic acid bath in *vacuo*, and then appeared as a beautifully clear and colorless crystaline body. The author conceives that in this state it might, in certain cases, be substituted with advantage for carbonic acid in frigorific processes, for arriving at degrees of cold far below those hitherto attained by the employment of the latter substance. Ammonia was obtained in the state of solid white crystals, and retained this form at a temperature of —103°.

The following liquids could not be made to freeze at —166°; namely, chlorine, ether, alcohol, sulphuret of carbon, caoutchoucine, camphine, and rectified oil of turpentine.

The following gases showed no signs of liquefaction when cooled by the carbonic acid bath, even when subjected to great pressure; namely,

Hydrogen, Oxygen, at a pressure of	27 atmospheres.
Nitrogen and nitric oxide at a pressure of	50 do.
Carbonic oxide at a pressure of	40 do.
Coal gas at a pressure of	32 do.

Proc. Royal Soc.

On some of the Substances which reduce Oxide of Silver and precipitate it on Glass in the form of a Metallic Mirror. By JOHN STENHOUSE, *Ph. D.*

It has long been known that aldehyde, when heated in a tube with ammonio-nitrate of silver, reduces the oxide to the metallic state, and forms a brilliant coating on the inner surface of the tube. Three other substances, saccharic acid, salicylic acid and pyromeconic acid were also known to possess the same property, though the coatings which they yield are much darker, and therefore less beautiful than those formed by aldehyde. This was the state of our knowledge previous to the announcement, about six months ago, of Mr. Drayton's process for silvering mirrors in the cold, by means of ammonio-nitrate of silver and an alcoholic solution of the oils of cloves and cassia.

I find that the number of substances which, especially when assisted by heat, give more or less brilliant coatings of reduced silver, is much greater than has hitherto been supposed. Thus grape-sugar forms a pretty brilliant mirror even in the cold. When unassisted by heat the mirror is rather slowly formed, requiring from six to twelve hours; but when a slight heat is applied it forms very readily in the course of a few minutes; the coating is much darker than that produced either by aldehyde or by Drayton's process. Cane-sugar also yields a mirror when assisted by heat, but none in the cold. Gum-arabic and starch also yield dark-colored mirrors, but more slowly, and require considerable boiling: so do phloridzine and salicine. Oils of turpentine and laurel also give mirrors, but with still greater difficulty, the solutions requiring to be very concentrated. Resin of guaiacum acts in a similar manner.

Oil of pimento, as is well known, consists of two oils, one an acid oil, which is heavier than water, and forms crystaline compounds with the bases; this in the course of a few minutes, even in the cold, produces as brilliant a coating of silver as the mixture of the oils of cassia and cloves. The neutral portion of the pimento oil, which is lighter than water, does not reduce nitrate of silver even after long boiling. I could not succeed in forming metallic mirrors with cinnamic, benzoic, meconic, komenic, tannic or pyrogallic acids, with gum benzoin, elemi or olibanum, with oil of rhodium or with glycerine.

Ingenious as Mr. Drayton's patent process certainly is, it labours under a very serious inconvenience, which I greatly fear will not be easily remedied. In the course of a few weeks the surface of the mirrors formed by his process become dotted over with small brownish-red spots, which greatly injure their appearance. The cause of the spots seems to be this—that the metallic silver while being deposited on the surface of the glass carries down with it mechanically small quantities of a resinous matter, resulting, most probably, from the oxidation of the oil. This resinous matter which is interposed between the glass and the silver, in the course of time begins to act on the metallic surface with which it is in contact, and to produce the small brown spots already mentioned. If an excess of the essential oils is employed to precipitate the silver, the metallic mirror is much darker, and gets sooner discolored than usual. No doubt the alcohol present in the solution keeps up much of the resinous matter; still a little of it is almost always deposited on the silvered surface, and acts in the injurious way described. Proc. Chem. Soc.

On the Electricity Developed in the Manufacture of Machine-made paper. By Dr. HANKEL.

From Poggendorff's Annales, as translated in Mr. Walker's "Electrical Magazine," for January, 1845.

That paper, when warmed, and afterwards rubbed on a table with a brush, or with Indian-rubber, presents very marked electric indications, is an experiment which is undoubtedly very well known.—

However, I think that the following short notice of the appearance of very powerful negative electricity, during the manufacture of machine-paper, will be interesting. This phenomenon was mentioned to me by M. Keferstein, a paper-maker at Krollwitz, near Halle; and I have myself had the opportunity of observing the same. When the paper has left the rocking-table, and the water has partly run through the wire-frame that passes, on an endless band, over a couple of rollers, and is then pressed out by a roller placed near the wire-frame; the paper thus made still remains damp, although it possesses some degree of solidity; it thence passes over to the rollers, which are heated by steam, and is accompanied among the first three by a hair-cloth, but goes over the fourth without the aid of a hair-cloth; after it has gone between the last pressing rollers, the very wide paper sheet is cut into three narrow stripes, of the width of an ordinary sheet of paper, by sharp circular cutters placed in a roller, and it is then rolled upon a cylinder. So long as the paper is accompanied by the hair-cloth, no signs of electricity are manifested; they appear when it leaves the last steam-roller, or rather, the last pressing-roller.

It appears by experiment that the heat of the last steam-roller exercises great influence, inasmuch as the electrical phenomena are much stronger the more the heat of the last steam-roller is increased; they are frequently so strong that very loud sparks dart from the paper to the last smoothing-roller (a small guiding-roller of copper,) and to the roller on which the cutters are fixed. If the finger is brought near to the paper, a rapid succession of small sparks are perceived to pass from it to the paper. A Leyden jar can easily be charged. The electricity remains in the paper for a considerable time.

When only a few coils of paper are on the cylinder, the electricity is feeble; but it increases considerably with the number of folds. If the paper is cut away from the cylinder, and the long strips are thrown asunder, many strong and very brilliant sparks fly between them. This electricity is evidently produced merely by the heating of the paper, and its being pressed by means of the rollers. No friction can take place, because the velocity of the circumference of all the rollers is exactly the same. The evaporation of water is certainly no cause of the electricity appearing at the end of the machine; since, just in those parts where the evaporation is the strongest, no signs of electricity are manifested; and the damp paper, being a conductor, conveys all that is so produced to the metal rollers.

Note.—Compare *Gib. Ann.*, vol. lxxv. p. 197.—I take the liberty of observing, that the appearance of electricity in the fabrication of paper is no new phenomenon: probably there are few proprietors of such manufactories who have not noticed it, as it is even a hindrance in folding the paper. In the meanwhile, this phenomenon has not been mentioned in the *Annalen;* nor, so far as I can discover, has it been noticed in works on natural philosophy; on which account the circumstance may be unknown to many readers of this journal.

A similar production of electricity has for many years been noticed in Mr. Mackintosh's manufactory at Glasgow, on tearing asunder the well known water-proof cloth, which is stuck together by means of a solution of Indian-rubber in coal-tar.*—*(Edin. Phil. Jour.* vol. x., p. 185.) Lately, also, they have been seen by Mr. Marsh, at Woolwich, on grinding newly roasted coffee in an iron coffee-mill; they passed between the mill and a tin can placed one-tenth of an inch distant.—*(Ann. of Elect.* vol. viii. p. 124.) Lastly, a very strong attraction has been noticed in a cotton-mill, in a broad endless band, that passes horizontally over two cylinders of almost 3 feet in diameter, which revolves seventy-two times in a minute.—Cotton-wool was attracted from a distance of two or three feet; and, four feet beneath the band, the hair of the workman stood on end.—*(Ann. of Elect.* vol. v., p. 397.)—*Editor of the Annalen.* Mechanics' Mag.

On a new Bleaching Principle produced by the slow combustion of Ether in Atmospheric Air, and by the rapid combustion of Bodies in a jet of Hydrogen Gas. By Prof. SHOENBIEN.

Prof. Shoenbein observing that a peculiar principle, in many respects similar to chlorine, was developed during a slow combustion of phosphorus in the atmosphere, was led to inquire into the product of the slow combustion of the vapor of ether mixed with atmospheric air. He finds that, besides well-known compounds, such as formic and acetic acids, there is evolved a principle hitherto unnoticed, which possesses oxidizing and bleaching properties in an eminent degree.—It decomposes indigo, iodide of potassium, and hydroiodic acid, and also, though more slowly, bromide of potassium. When in contact with water, it converted iodine into iodic acid, and sulphurous into sulphuric acid; changes the yellow ferro-cyanide of potassium into the red, and the white cyanide of iron into the blue; it transforms the salts of prot-oxide of iron into those of the peroxide, and it discharges the colors produced by sulphuret of lead. The author points out the similarity between the action of this substance, in these instances, and that of chlorine and ozone. Analogous results were obtained from the combustion of a jet of hydrogen gas in atmospheric air, and even, under particular circumstances, from the flame of a common candle, and also from various other inflammable bodies when burning under certain conditions. The author is hence led to the conclusion that this peculiar oxidizing and bleaching principle is produced in all cases of rapid combustion taking place in atmospheric air, and that its production is therefore independent of the nature of the substance which is burnt. Proc. Royal Soc.

On the Artificial Formation of a Vegeto-Alkali. By GEORGE FOWNES, Esq.

The substance which is the subject of investigation in this paper is a volatile oil, obtained by distillation from a mixture of bran, sulphuric acid, and water, and is designated by the author by the name of

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* We may mention that the two cloths are passed between two steam-rollers highly heated; and that the adhesive solution is between the cloths as they enter the rollers.—Ed. Elec. Mag.

Furfurol. Its chemical composition is expressed by the formula, $C_{15}\ H_6\ O_6$, and its properties are the following:—When free from water and freshly rectified it is nearly colorless; but after a few hours, it acquires a brownish tint, which eventually deepens almost to blackness. When in contact with water, or when not properly rendered anhydrous, it is less subject to change, and merely assumes a yellow color. Its odour resembles that of a mixture of bitter almond oil and oil of cassia, but has less fragrance. Its specific gravity at 60° Fahr. is 1.168. It boils at 323° Fahr., and distils, at that temperature, without alteration. It dissolves to a large extent in cold water, and also in alcohol. Its solution in concentrated sulphuric acid has a magnificent purple color, and is decomposed by water. Nitric acid, with the aid of heat, attacks the oil with prodigious violence, evolving copious red fumes, and generating oxalic acid, which appears to be the only product. It dissolves in a solution of caustic potass, forming a deep brown liquid, from which acids precipitate a resinous matter.—With a slight heat, it explodes when acted upon by metallic potassium. When placed in contact with five or six times its bulk of liquid ammonia, it is gradually converted into a solid yellowish white and somewhat crystaline mass, which is very bulky, perfectly soluble in cold water, and easily obtained in a state of dryness under a vacuum. The formula expressing the chemical constitution of this substance, or of *furfuroamide*, is $C_{15}\ H_6\ N\ O_3$, and it is classed by the author with the *amides*. The oil itself appears to be identical with the substance described by Dr Stenhouse, under the name of artificial oil of ants. Another substance. isomeric with the *amides*, and of which the formula is $C_{30}\ H_{12}\ N_2\ O_6$, was obtained by the author, and termed by him *furfurine*, and found to have the properties of a vegeto-alkali and to form saline compounds with various acids. Proc. Royal Soc.

TRANSLATIONS FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the Absorption of the Rays of Heat by the Terrestrial Atmosphere.—Extract of a letter from M. Melloni *to* M. Arago.

The only pages of my memoir, which may probably excite interest, are those in which are reported, for the first time, the results deduced from a long series of observations on Solar heat. In numerous repetitions, by means of the same prism of rock salt, of the analysis of these rays, I have proved that the *maximum* of temperature is not always in the same place in the dark space which is prolonged beyond the red limits of the spectrum, but sometimes more and sometimes less distant from the colored portion, and that under circumstances perfectly similar with regard to radiating force, to the serenity of the sky and the transmission of the air. I conclude from this, that the calorific rays deprived of light, reach us in quantities greater or less according to the condition of certain atmospheric constitutions which exert no influence on the transmission of luminous rays. Now, it appears to me that there is a striking analogy between this phenomenon and that observed by M. Daguerre, relative to the direct action of the chemical radiations corresponding to equal heights of the sun above the horizon. In the latter case, it would be the dark part of that radiation, situated beyond the limit of the violet, which would undergo, on its way, a greater or less absorption, in virtue of a certain modification, which might not alter the transparency of the atmosphere. It is true that, on this hypothesis, we must admit that the permeability of the air for the dark chemical rays, may be different in certain cases from its permeability for luminous rays. But are we not in possession of very many facts which prove that this is actually the case with regard to optical, calorific, phosphogenic and chemical effects produced by the same radiation?

Ann. de Chem., Nov., 1839

On the force of tension of some condensed gases. *By* M. Bunsen.

I first measured the resistance of the glass tubes which I intended to use. I filled them completely with water (after introducing a small manometre) and then plunged them into water, which I gradually heated to the boiling temperature—which, by the expansion of the water within the tubes, represented a pressure of 150 atmospheres. When the tubes burst under this pressure there were generally an infinite number of longitudinal parallel fissures and accompanied by a piercing noise.

A tube of $11\frac{1}{3}$ millimetres in internal diameter and $1\frac{1}{5}$ mill. in thickness, burst under a pressure of 80 atmospheres, and I found tubes of a smaller diameter which resisted 200 atmospheres. But after a while their tenacity became so diminished that some of them which had supported 30 atmospheres, suddenly broke under a pressure of scarcely 4 atmospheres. I attribute this to a diminished elasticity in the glass, like that of all other bodies, in proportion to the length of time in which they have been subjected to great pressure.

I have submitted cyanogen, sulphurous acid, and liquid ammonia to different temperatures, in glass tubes containing a manometre, and the result was the following tensions, calculated in metres of mercury.

Temperatures.	Sulphurous Acid.	Cyanogen	Ammonia.
— 33.7			.749
— 30.0			
— 25.0			
— 20.0		.80	
— 15.0		1.10	
— 10.0	.78	1.41	
— 5.0	1.11	1.73	3.64
0.	1.48	2.07	3.61
+ 5.0	1.91	2.44	4.26
+ 10.0	2.89	2.88	4.98
+ 15.0	2.93	3.33	5.78
+ 20.0	3.54	3.80	6.67
+ 25.0	4.20		

Sulphurous acid boils at —10°.5 under a barometric pressure of 0.744 metres.

Cyanogen becomes liquid at —25°c, and begins to solidify at —30°, assuming a radiated texture. Its boiling point is —20.7c.

Ammoniacal gas must be perfectly dried before being liquified. Its boiling point is —33°.7.

I have in vain tried to reduce to the liquid state, by a reduction of temperature as far as —50°, the gas which results from the combination of hydrogen with chlorine, brosmine, iodine and phosphorus.

We may obtain sulphuretted hydrogen in a liquid state by subjecting hypersulphuretted hydrogen to decomposition in a tube; but it requires the presence of a little water. If bits of chloride of calcium be introduced into the tube, the hypersulphuret may be preserved intact while the tube remains hermetically sealed.

Annales des Mines, tom. xvii, p. 317.

Chemical constituents of Sugar Beet. *By* HENRY BRACONNOT.

It results from the researches that I have made on the Sugar Beet of Silesia, that this root contains—1, crystalizable sugar; 2, non crystalizable sugar; 3, albumine; 4, pectine; 5, mucilaginous matter; 6, liqueous matter; 7, phosphate of Magnesia; 8, oxalate of potash; 9, niclate of potash; 10, phosphate of lime; 11, oxalate of lime; 12, an acid fat having the constitution of tallow; 13, matter analogous to wax; 14, chloride of potassium; 15, sulphate of potash; 16, nitrate of potash; 17, oxide of iron; 18, animalized matter soluble in water; 19, an unknown odorous and acrid matter; 20, indeterminate sal ammoniac in small quantity; 21, pectic acid. Ann. de Chem. Dec., 1839.

Manufacture of Leaden Bullets, by rolling.

At the Arsenal, at Woolwich, in England, they now manufacture leaden bullets by drawing and compression.

These bullets have the advantage of being without *blows* or air cavities, and are rolled out of round bars of lead, which are passed between rolls formed like the roulettes used for ornamental work on the lathe.

The rolls are constructed with hemispherical cavities, each one of which forms one half of the ball, whilst the correspondent cavity forms the other half; the bullets are then finished by removing the extra metal, and being rolled together in a barrel. Journal des Usines.

On the Irregular Movements of the Barometer. *By* T. HOPKINS.

Mr. Hopkins maintained that the *irregular* movements of the barometer arise, not from the alterations of surface temperature, but from the condensation of aqueous vapour, and the consequent formations of rain. This (he said) caused local heatings of the atmosphere and considerable reductions of its pressure in the locality, particularly in the colder latitudes. Within the tropics, the barometer does not ordinarily fall as much as in colder latitudes, notwithstanding the abundant rains which take place there, because the condensation occurs, and the temperature is increased at a greater height in the atmosphere, and the reduction of the incumbent pressure in the part is spread over a wider area. The condensation takes place too at an elevation, where the air, from being subjected to inferior pressure, is more attenuated, and the heating is consequently more diffused. Rain is formed in certain latitudes, say at an average height of 3,000 feet, where the air has a density proportioned to that height, and where the whole effects of the local heating are confined to an area of moderate extent, thus reducing the pressure of the atmosphere on the barometer in every part of that area in a considerable degree; whilst, in other parts nearer the equator, the condensation which produces rain takes place at an average height of, say 6,000 or 9,000 feet, where the air is rare in proportion to the height; the heating effects are, therefore, diffused to a corresponding extent, whilst the reduction of pressure at the surface is spread over a wider area. It follows, that with equal amounts of rain, the fall of the barometer will be the greatest and confined to the smallest area, in the coldest climates. Mr. Hopkins also represented that the *diurnal* oscillations of the barometer arise from, first, the condensation of aqueous vapor into cloud, and then from the evaporation of the particles of water that constitute that cloud. He stated, that the morning sun warmed the lower air, and caused it to rise until condensation formed cloud, and liberated heat sufficient to warm a mass of the atmosphere, and thus to cause the barometer in the locality to begin to fall at, say about ten o'clock in the morning, which fall continued until about four o'clock in the afternoon, when condensation ceased. From this time, evaporation of the cloud commenced which cooled the air in part —made it heavier—and caused the barometer to rise until about ten o'clock, P. M., by which time the cloud was evaporated. The cooled and heavier air now descended to the surface, from which it absorbed a portion of heat, and became somewhat warmer. From this second warming of the air, and from a reduction of the quantity of aqueous vapor in the atmosphere, as is evidenced by the fall of the dew point, the barometer again fell, and from the operation of these two causes, continued to fall until four in the morning; from which time, those general cooling influences that operate in the absence of the sun, caused the barometer again to rise till ten in the morning, thus completing the two risings and two fallings in the twenty-four hours.— This was shown to be in general accordance with the tables of the Plymouth observations for three years, and with those made at Madras and Poona. The fact, also found in the Plymouth observations, that the dew point rose with the temperature until eleven o'clock, A. M., when, although the temperature continued rising, the dew-point did not rise higher, showed that the vapor formed during the hottest part of the day was expended in supplying that which was condensed in forming the daily cloud. According to these tables, also, the dew point at the surface continued stationary until four o'clock, P. M., when it began to fall, and continued falling with the declining temperature until the great cold resulting from evaporation ceased. The diurnal fluctuations were also shown to be the least, when the irregular were the greatest (as observed by Mr. Birt,) because rain was then produced, and evaporation prevented from cooling the air at the regular diurnal period, and in that way prevented the rise of the barometer at that recurring period. London Athenæum.

Statistics of Hosiery.

Mr. Felkin read a paper on the statistics of the Hosiery manufactured by machinery in the United Kingdom, compiled from an actual census taken under his direction in the present year. He stated that before the age of Elizabeth, stockings were either knitted of coarse woolen thread or cut out of linen and silken tissue. Towards the close of the sixteenth century the Rev. W. Lee succeeded in producing the stocking-frame, and his ingenuity was appreciated by Queen Elizabeth, who visited him at his lodgings, and accepted specimens of his productions. Her kinsman, Lord Hunsdon, entered into a kind of partnership with Lee, and one of the Tudor family became the first stocking-makers' apprentice. James I. refused to follow the enlightened policy of Elizabeth; and Lee, neglected in England, accepted the offers made by the French minister Sully; he established a manufactory at Rouen, but after the murder of Henry IV. the patronage he had received was withdrawn, and he died of a broken heart. The stocking-frame spread rapidly over England, France, Spain, and the Netherlands; Lee's brother introduced the manufacture into London, where the "Frame-work Knitter's Company" still exists, though it has been long an empty name. Out of 660 frames, in 1669, there were 460 in London, three-fifths of the whole being employed in the manufacture of silk goods. In 1710 there were 100 frames destroyed in London on account of disputes about wages, and in 1714 there were 2,500 frames in London, 600 in Leicester, 400 in Nottingham, and about 8,600 throughout all England. From this time the trade began to leave London, probably from the vexatious nature of the company's regulations; and in 1753, when the total number of frames in England was 14,000, London had fallen to 1,000, while Nottingham had risen to 1,500, and Leicester to 1,000. The application of the stocking-frame to the manufacture of imitations of pillow lace, led the way to a great variety of ingenious inventions, and a consequent extension of the trade: in 1782 there were about 20,000 frames in England, of which 17,350 were in the midland counties.—Though the stocking-makers and lace-makers started from the same point, their fate has been very different; the manufacturers of stockings are about the worst paid and those of lace among the best paid of the operative classes. Mr. Felkin stated that there are about 42,652 persons engaged in the manufacture of stockings, and as many more employed to wind, seam, and sew up the hose. He denied that as a class they were idle and negligent; he had known them from boyhood, having worked for his support at their frames, and he knew that they were no worse than hard work and small wages would make any class of the community. To explain the position of the stocking manufacturers, Mr. Felkin stated that the frames were rarely the property of the workmen, but belonged either to the hosiers or to a class of middlemen, who let them to the operatives. Foreign competition has had little effect upon this branch of industry, for the amount of the exportation of hosiery has never been important. There were only 147,507 dozens exported in 1843, and that was nearly double the amount of the preceding year. Mr. Felkin then referred to some diagrams exhibited in the Section, to explain the nature of working the frames; the operation is one of considerable toil, but does not for ordinary goods require much skill and training; the employment is injurious to the sight. It is for the most part a domestic branch of industry, and has no connexion with the factory system. The total number of frames in the three midland counties is 39,442 employed and 4,298 unemployed. There are 1,572 frames in the rest of England, 265 in Ireland, and 2,605 in Scotland; and taking the whole of Great Britain there are 42,632 employed and 5,830 unemployed, (many of the latter, however, being under repair,) making a total of 48,482 frames available for the machinery of the trade. The earnings of the frame work knitters are subject to heavy deductions, for the rent of frames and other incidents, which frequently reduce the net earnings to a most miserable sum. The earnings, clear of shop deductions and expenses, range generally from 4*s.* 6*d.* to 7*s.* per week, and in some places, where cotton-hose is chiefly made, wages are even lower than the above minimum. Many cases of hardship from excessive frame rent were recorded; and it deserves to be remarked, that frames are not perishable articles, many of those now in use having been manufactured in the reign of Queen Anne. The general condition of the frame-work knitters is described as very deplorable; they work generally from fourteen to fifteen hours per day, and their net earnings are generally inadequate to procure subsistence for themselves and their families. The ultimate results of the hosiery trade are to turn imported raw materials and those of home-growth of the collective value of 705,900*l.* into the selling value of 2,562,713*l.* There are manufactured annually 84,000 dozen of silk stockings and socks, 2,164,000 cotton, and 1,770,000 of worsted. Including gloves and other hosiery products, the annual production is 5,705,600 dozen, which would not give more than one pair of stockings and one pair of gloves for each inhabitant of Britain. Ibid.

On a Method of Electrotype, by which the Deposition on Minute Objects is easily accomplished. By L. B. Ibbetson.

From the difficulties which arose from the application of plumbago, in the ordinary manner, a portion of the plumbago was united with a solution of phosphorus in oil, and the article to be electrotyped immersed in it. It thus became covered with a coating, on which the metal was deposited in a beautiful and uniform manner. Such specimens of cactuses thus covered with metal were exhibited.

London Athenæum.

JOURNAL

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JUNE, 1845.

Extract from an account given in the London Mechanics' Magazine of the late Boiler Explosion at Messrs. Samuda & Co.'s Manufactory.

We now publish full details of the circumstances of this deplorable accident, so far as they have been yet brought to light; and though they do not, perhaps, comprehend everything which it might be desirable to know, they disclose quite sufficient, we apprehend, to enable every one to form a tolerably correct opinion of the causes to which it is to be ascribed. The verdicts of the jury impute blame to the head of the establishment, Mr. Samuda, and something more than blame to his foreman, Lowe; blame to the former, for the general inefficiency of the engineering arrangements of his manufactory, and "manslaughter" to the latter for the fatal recklessness with which he endeavored to make up for the fault of his master. The buying of an old and discarded boiler to do the work of a considerable manufactory,—the employing a low-pressure boiler to do the work of a high-pressure one—the complicated and defective character of the arrangements for ascertaining and regulating the pressure—and the distance at which the boiler was placed from the engine, involving as it did a difficulty in keeping up the steam, and leading to all sorts of clumsy and hazardous expedients to obviate it—are all matters which came within the peculiar province of the head of the establishment, and which seem to us fully to justify the censure passed upon him by the jury. Indeed, rather more; for if a man sets another to do a thing manifestly perilous to life or limb (as this was,) and if especially he has the authority of a master over that other to command or forbid, he it is who is the real author of any calamity which may ensue.—

Qui facit per alium facit per se is an old and sound maxim. Mr. Samuda did not, to be sure, direct Lowe to prop up the valve lever, to prevent the valve from easing the boiler when charged beyond its power of bearing, (the ground apparently of the heavier offence of which the latter has been found guilty.) and cannot be supposed to have ever imagined that the man would act so foolishly; but it is, at least, equally true that if Lowe had had better machinery and tools to work with—*such machinery and tools as a judicious and discreet master would have provided him with*—there would never have been any occasion for his committing the gross indiscretion of which he was guilty.

The jury denounce "the application of low-pressure boilers to high-pressure purposes" as "highly dangerous," and recommend that "some legislative enactment" should be applied for, "to prevent, if possible, the fearful destruction of human life which arises under the present imperfect system." We agree with them that the practice is a "highly dangerous" one; but do not see that there is any necessity for invoking the aid of the legislature to put it down. The practice is an exceedingly limited one, and wholly unknown to all our first-rate engineering establishments (with the exception, perhaps of one or two, *not of the Thames.*) An instance here and there, or now and then, does not constitute a "system," nor a couple of fatal accidents in one establishment, such "a fearful destruction of human life" as the Collective Wisdom of the country alone can grapple with. A sufficient check to the spread of the practice will probably be found in the public obloquy, which every established case of disaster arising from it, must entail on the individuals guilty of it; and it is from a belief, that such checks can be administered through no channel so well as the public press, that we now contribute the aid of our columns to make the particulars of the present case as widely known as possible.

Fig. 2.

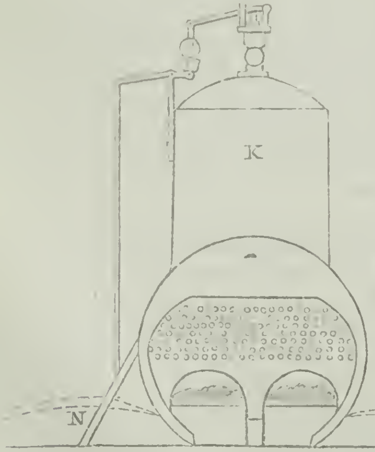


Fig. 1.

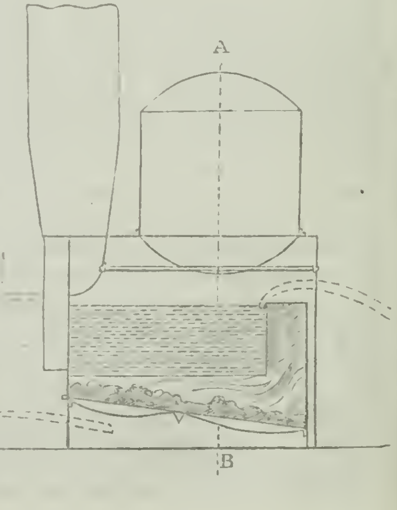
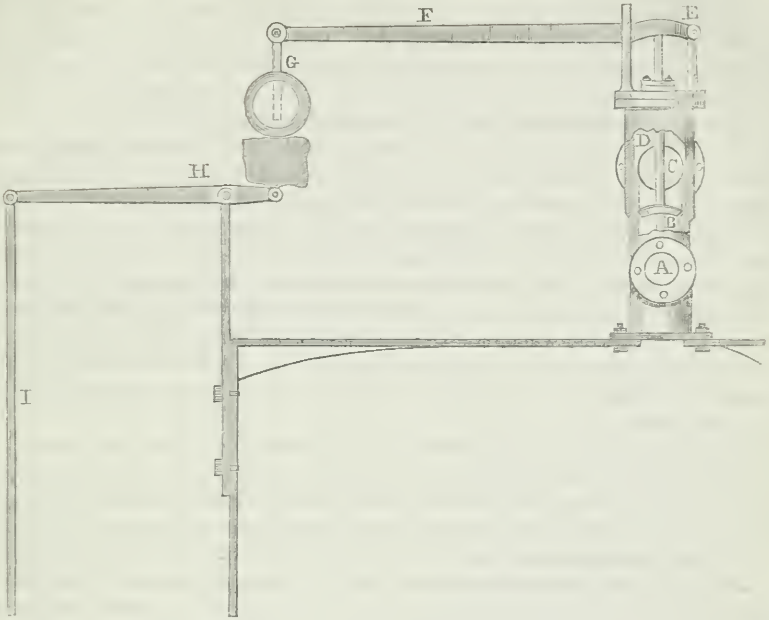


Fig. 3.



The engravings, Figs. 1 and 2, represent the boiler which was blown up; they have been reduced from the drawings exhibited at the inquest. Fig. 1 is a side elevation, and Fig. 2 a section on the line A B of Fig. 1. The boiler was on the tubular plan, and contained 182 tubes, each 5 feet 6¾ inches long, 2¼ in diameter at the back, and $2\frac{1}{4}\frac{1}{32}$ ins. at the fire door. The boiler plates were of ⅜ in. iron. The steam-chest (K,) which was 4 ft. 6 ins. in diameter, and 4 ft. 6 ins. deep, was made of $\frac{5}{16}$ in. iron. The crown of the boiler *had no stays;* an omission, the consequences of which the reader will find well pointed out in the intelligent evidence of Mr. Barnes. The dotted lines on the right hand, in Fig. 1, show the position in which the upper row of tubes (made of copper) was found after the accident—completely bent over, but still adhering at one end to their seats. The dotted lines in Fig. 2 show how the external case of the boiler was blown out to the right and left, in consequence of the steam taking the line of least resistance, that is, upwards through the *unstayed* crown. Fig 3 represents, on a larger scale than in Fig. 2, the steam-valve arrangements. A, was the pipe leading to the engine; B the safety-valve, the inner diameter of which was $4\frac{3}{32}$ ins.; the outer, $4\frac{9}{16}$ ins. C waste-pipe leading to the chimney; D the interior of the valve-box, $5\frac{1}{32}$ ins.; E the fulcrum of F the lever. The length of the lever was 3 feet; the distance from the fulcrum to the centre of the valve and spindle 3 ins. G rod, 13½ ins. long, which carried two weights, one circular and the other square, suspended from the end of the lever. H a second lever employed to control the first, 2 ft. long, and turning on a fulcrum 5 inches from the centre of the suspended weights; I hand-rod hanging from the lever H, by which the entire system of levers was moved. N (fig. 2) is the piece of wood with the nail in it (not seen in the figure) by which the levers were prevented from acting, and the explosion produced.

Neither the exact amount of the weights suspended from the first lever, nor the weights of the valve and levers themselves, appear on the face of the proceedings; and without these it is impossible to calculate the actual pressure to which the boiler was subjected. This is of no great consequence however; for, as suggested by Mr. Barnes and Mr. Farey, in their evidence, this is not a case where the question turns on the *particular amount* of pressure exerted, but where the stoppage of the valve set all calculations of resistance at defiance.

There were five persons killed by the accident; and there have been two Inquests, of the proceedings of which the following is an abstract, stripped of everything which has not some material bearing on the case.

Evidence before the Coroner.—Mr. Frederick Braithwaite, engineer, examined.—The boiler was what is termed a tubular boiler, the dimensions of which are stated in the plans given in. It was intended to drive one of a pair of 25-horses low-pressure engines on board the Waterman steamer, No. 11. It had been applied to that purpose. It could not make sufficient steam, and was taken out after it had been used some ten or twelve times. It was too small as regards the steam required to be created for that purpose. Had seen the boiler for several months standing on Fairbairn's premises, but had lost sight of it for months till he saw it after the accident. Did not know when Samuda bought it. The boiler was made about 18 months back—certainly within two years.

John G. Burnard examined.—Is a millwright and engineer, and was in the employ of Messrs. Samuda.—I cannot say there was more than 20 lbs., but I believe so. I did not weigh the valve. The handle of the safety-valve was propped up so as to prevent its acting.—There were two weights, one round, the other square; that on the safety-valve was square, (a plan was here put in illustrating the Witness's meaning. See fig. 3.) I saw the piece of wood placed against the boiler to keep the lever of the safety-valve up. Lowe told me to get a hammer and a nail. I could not get a hammer, so brought a chisel, and drove the nail with it. Lowe held the handle of the lever of the safety-valve whilst witness drove the nail into the wood. In doing so, Lowe pulled the handle down, upon which the steam blew off strongly. After the nail was driven, the piece of wood was placed under the handle of the valve, thereby supporting it, and preventing its action. I saw Lowe place the wood against the boiler, after which the nail was applied. The handle of the lever of the safety-valve, before the wood was brought, rested on a rivet in the boiler. The nail would not bear so much pressure as the rivet, although it would have the same effect. I removed the lever off the rivet several times, because I thought it dangerous, and that no one in their senses would do as Lowe had done, as it prevented the use of the safety-valve altogether. When he left the boiler, the handle of the safety-valve rested on the nail. The explosion took place ten minutes or a quarter of an hour after. There was only one safety-valve. There was no steam-gauge on the boiler, but there was a water-gauge, which was broken. There were two gauge-cocks, but they were not put on in the proper place. The upper one blew off steam instead of water.

Mr. John Farey, C. E., examined.—Had seen the boiler since it had been removed from the spot where it stood at the moment of the explosion. The boiler had burst the exterior shell outwards; it had not collapsed. The boiler has been burst by a very intense pressure, which is not accountable for by any supposition of the safety-valve seen by witness being merely overloaded, but that it must have been fastened down, which circumstance rendered this case very distinct from most of the explosions on record. All the steam which was produced being retained and accumulated in the boiler to a pressure which burst the metal with extreme violence, projecting large pieces to a great distance through the air. One piece in particular had cut itself into the bricks of a wall at a considerable distance from the boiler, which showed that that particular piece had been projected with a velocity to be expected from an explosion of gunpowder, but not from the ordinary explosion of overloaded steam boilers. The earth whereon the boiler stood had been forced downwards by the violence of the explosion, that being a symptom frequently found in the explosions of gunpowder, but not a usual symptom in explosions of steam boilers. These appearances convinced witness, quite independently of any information to that effect, that the safety-valve had been fastened down; and the engines not working at the time to any speed which would consume steam, all that was produced was accumulated, and having little or no escape, or expenditure, that accumulation caused the explosion. It is quite true that 100 lbs. on the square inch could not have produced the effects he had seen there. Witness was no convert to the theory of the production of gas within a steam-boiler, or that the explosion of hydrogen gas could be produced, unless in cases where the boiler was nearly empty, and the iron red hot in the vicinity of water. There were no appearances in this case of that having taken place. Had never met with one case under these conditions. No atmospheric air can get into a boiler when under pressure. The supposition that hydrogen gas may be produced within a boiler is, that a portion of water has had its oxygen absorbed from it by the oxidation of the heated metal of the boiler. If that did take place, oxide of iron must be found in the boiler in palpable quantities. There were no appearances in the present case of any oxide of iron. Another supposition is requisite to account for an explosion taking place from the hydrogen gas supposed to be produced, viz., that atmospheric air, or oxygen in a gaseous state from some other source, should become mixed with the hydrogen, for it is only the mixture of hydrogen and oxygen, in their gaseous states, which is susceptible of explosion. The explosion being, in fact, a combination of the two gases, previously mixed in suitable proportions for combining, and by their combination at the moment of explosion, or ignition, they produce water. The supposition is that water is first decomposed, and afterwards recomposed. In the present case there were no symptoms of such having been the case, or of any oxidation. There were no appearances of deficiency of water in the boiler. The uppermost row of tubes, which must have been the first to have been laid dry by deficiency of water, were of brass, and show no symptoms of having been overheated; and if they had been overheated, brass would not absorb oxygen from water in sufficient quantities to have liberated any hydrogen. The tubes lower down were iron, and presented no appearance of having been red hot. No one can mistake iron that has been red hot. Has had many years' experience of explosions in gas works,—they were occasioned by a mixture of hydrogen gas and common air. Such explosions are always attended with fire and burning. Was acquainted with attempts some years ago to construct engines to be impelled by means of a vacuum and such explosive actions as substitutes for steam-engines. The symptoms attending such explosions are so distinct from anything belonging to this case, as to leave no doubt whatever on witness's mind, that the accident was not occasioned by ignition of gas, but by steam alone, confined and retained to an excessive pressure. There are two cases on record of similar explosion from safety-valves being fastened down. One of the earliest was a case of a boiler of one of the earliest attempts at locomotive engines; the other was at Lyons, where Mr. Steel lost his life. Except from gunpowder, never saw such an explosion as the present in its effects.

The Coroner, in summing up, observed that in his opinion, the evidence showed, most distinctly, there had been an undue pressure of steam upon the boiler; and he could not but lament that the remarks which fell from him upon the occasion of the inquest on the parties killed by the explosion on board the Gipsy Queen had not had more effect in inducing a proper degree of caution.

The jury retired for half an hour; and on returning into court,

The Foreman stated that it was the unanimous opinion of himself and brother jurors that "George Lowe was guilty of manslaughter." The foreman said he was further instructed by the jury to express their opinion "That the machinery employed on Mr. Samuda's premises was altogether of an inefficient character."

The Coroner said he quite agreed with the verdict of the jury; and he hoped that the caution with which they had accompanied it would have a proper effect on Mr. Samuda.

On the Condition and Ventilation of the Coal Mine Goaf. By Prof. Faraday.

None of our readers can have forgotten the terrible loss of human life which occurred at the Haswell Colliery, in the county of Durham, last September. Ninety-five persons perished in an explosion within that mine. Professors Lyell and Faraday were immediately sent by the Secretary of State to attend the judicial investigation which was held in consequence of the accident, and to inquire into its cause.— These gentlemen have since made a Report to the proper authorities, which is now before the public; and the object of Prof. Faraday's communication was, to illustrate by experiment what he had represented in that document. The arrangement adopted by the Professor invited attention, 1. To those parts of the mine in which the explosion occurred. 2ndly, to the circumstances of the calamity. 3rdly, to the means of preventing the recurrence of a similar accident. 1. With respect to the locality of the explosion. It appears to have occurred at a spot in the mine which Professor Faraday described with great accuracy: this is called *the goaf.* In working a mine, low, narrow passages, at right angles with each other, are cut through the seams of coal. The square masses made by these passages are called pillars. These pillars are gradually cut away, and replaced for a while by systems of wooden props; and the place where these props replace a pillar is called a jud. In time the jud is removed, and then the unsupported roof of the mine falls in. The heap of ruins thus occasioned by the successive drawing of contiguous juds is called by miners *a goaf.* When the mine is deep, and has been long worked, the size and height of the goaf are enormous: one of the goafs at Haswell extends over thirteen acres, and the height of it cannot be ascertained. Corresponding with this heap of rocky fragments, and produced by it, is a cavity in the mine like an inverted basin, including a thin belt of air which surrounds, and partly permeates, the goaf. It is this aërial space which Professor Faraday regards as a magazine of danger.— The air itself is, or may be, the fire-damp (the light hydro-carbon gas) and common air, mixed in very various proportions. The lightness of this gas, and therefore of the mixture, causes it, if present, to ascend into the upper part of the goaf cavity, which is then converted into a reservoir of explosive matter. Prof. Faraday, secondly, described the probable circumstances of the accident as it happened.— Some disturbance of the goaf-cavity, occasioned by the drawing of a jud, and possibly a change of the pressure of the atmosphere, diffused the fire-damps through the workings at that place. This, when lighted, would, by the explosion, raise, and then kindle, the coal-dust which is always abundantly pervading the passages; and these effects must, in a moment, have made the part of the mine, which was the scene of the calamity, to glow like a furnace. This conflagration was necessarily succeeded by vast volumes of the poisonous choke-damp (carbonic acid gas,) so that it was humanly impossible for any one within the range of the explosion to have escaped alive. Prof. Faraday then entered, thirdly, on the most important part of his subject, viz. *the prevention of such calamities when occasioned by the goaf.* He proposes the ventilation of the goaf. He expressed his opinion, that it would not be so well to attempt this by driving the contents of the goaf through any parts of the mine which are occupied by human beings; but he exhibited how the goaf-cavity might be exhausted of noxious air by means of a pipe rising as high as possible—from four to eight or ten feet—into it, and communicating at its other extremity with the return way, or the upcast ventilation-shaft. He illustrated the readiness with which this might be done, by most conclusive experiments. He filled a glass vessel (which represented the goaf-cavity) with inflammable air, smoke, &c., and then exhausted it in a few seconds, by means of a pipe communicating with the flue of one of the small furnaces in the theatre. He used tubes of thin sheet iron and of air-proof cloth for experiments on large and rapid currents, proposing (to avoid the effect of excess) to suspend them, or place them on props in the open space of any passage most convenient for the purpose; and said that such a tube, or even others made by nailing four boards together would be sufficient for the purpose. He showed that the terminal ends of these need not be reversed every time the upper end of the goaf changed its form, and concluded by confuting objections that had arisen in his own mind, or might be urged against the details of the arrangement he recommended, and stated his belief, that it was in reality as practicable as it was theoretically unimpeachable. Lond. Athenæum.

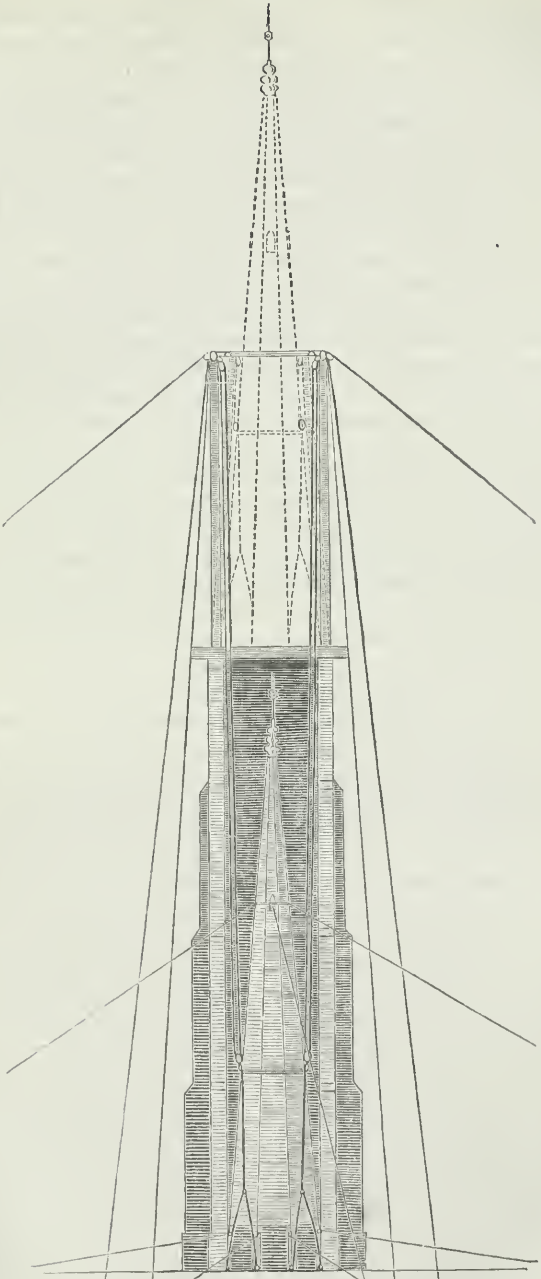
Expeditious Bridge Building.

Mr. Dredge has just erected a bridge over the Blackwater river, county Tyrone, Ireland. This Bridge has been in contemplation nearly forty years, the only obstacle being the immense expense of any structure on the old system, and probably for forty or a hundred years more the county would have been deprived of the advantage now conferred, but for Mr. Dredge's estimates, and his highly-approved plan. Mr. Dredge has not added much to the long delay, by any dilatory process of construction; when the iron was on the ground he astonished the public with the rapidity of the work, the bridge being extended and completed *in one week.* The bridge is 74 feet span, and for the heaviest traffic. It was erected at the cost of the Earl of Caledon.—*Wiltshire Independent.*

Account of the Raising of the Spire of the Church of the Nativity, in Spring Garden, Philadelphia county. By N. Le Brun, Architect.

Communicated for the Journal of the Franklin Institute.

The Doric tower on which this spire was raised, faces the east, and is 90 feet in height, it is strengthened at the angles by four double buttresses, projecting at the base four feet; the projection of these buttresses is diminished at four stages in their height. The interior figure of the tower at the base is a square, but mid-way it assumes the figure of an octagon by gathering over the brickwork at the angles; the whole forming a construction of the most solid character. The octagonal spire, which was finished complete in front of the tower previous to raising, is 80 feet high, including its crowning ornaments; its width at the base is 12 feet 6 inches.



RAISING OF THE SPIRE OF THE CHURCH OF THE NATIVITY.

The spire was raised by means of two derricks situated on the north and south walls on the top of the tower, and placed about 18 inches behind the front posts of the spire, or about 3 feet back from the front of the tower, and were 13 ft. 6 in. apart, allowing about 6 ins. on each side between them and the spire. Their feet were made convex and fitted into corresponding concavities worked in the oak sleepers which were securely bolted down into the sills of the spire, which sills were themselves secured to the tower by 1½ inch iron rods 36 feet long and built in the angles of the tower walls. To avoid all the strain being thrown on the top of the walls at these points, diagonal braces were placed, extending 40 feet down the tower, and as an additional precaution to prevent the derricks from slipping at the heels they were connected by lashings fastened to iron bolts passed through them,—the heads were connected by two tackle blocks, which were only of use to keep them in their position till the spire was being raised. The guys from each of the derricks, extended in three directions over the neighbouring commons.

The spire was connected with the derricks by four double lashings, (each end of which was fastened to one of the spire posts at the foot,) and two spans; the belt which connected the spans, was 30 feet high above the base of the spire, (being about 5 feet above the centre of gravity) and passed through the straps of the purchase blocks. The falls from the treble blocks on the derricks to the leading blocks, were in the interior of the tower, and the two capstans used, were placed in the main story of the church and were each manned by twenty men. Attached to the base of the spire were three guys and at about 25 ft. from the head were four more guys, all secured to guy posts.

All the arrangements having been made with the greatest care, on the 10th of February, at two o'clock in the afternoon, the raising was commenced, and it was performed with the greatest ease. The spire was kept plumb by the management of the guys attached to it. As the derricks were but 42 feet high and the belt to which the purchase blocks was fastened was 30 feet from the base, (at which height the distance from each derrick head to the spire would be about 3 feet,) there would be but 6 feet between the blocks when the spire would be raised;—they would thus necessarily have lain almost horizontal, and caused a great strain on them; to avoid this strain, as the raising was progressing, the north and south derrick guys were slackened to make the purchase blocks work more perpendicularly.

When the spire had been raised to its proper height in front of the tower, the two west derrick guys were worked by two crabs to draw over the derricks and swing the spire to its destined position. It had been deemed most prudent to work them in that manner, as in the hauling in of the back guys in the usual manner, an oscillatory motion might have been communicated to the spire, which would have rendered it difficult to manage at this most critical moment. The raising lasted one hour and thirty minutes, and thirty minutes was required to secure it firmly to the sills on the tower by the iron straps; —thus the whole operation occupied two hours.

On the Causes of the great Versailles Railway Accident. By J. Gray.

From various facts and circumstances connected with the accident on the 8th of May, 1842, on the Left Bank Paris and Versailles Railway, Mr. Gray became convinced that nothing but a failure in the front axle of the *Matthew Murray* engine could have been the first cause of her right hand front wheel first slipping within the rail; and having the inquiry thus far concentrated, he proceeded with an examination of that axle, and of the facts and incidents connected with its failure: and he came to the conclusion that, with good materials and proportions, and the axles in a state of repose as received from the forge, or, in other words, perfectly free from the effects of cold swaging, or hammer hardening, an axle in such a state, and of ample dimensions for its intended work, will effectually resist fracture for any period the wear of the journals may enable it to run; but if the dimensions be deficient, the iron will be taxed beyond its permanent cohesive power and elasticity; and, however slight the excess of exertion and fatigue may be, a gradual and inevitable dissolution of particles must result; but, beyond this, he had not met with anything, either in print, in observation, or in the course of experience, that would at all warrant a belief in iron necessarily changing its quality, or becoming crystalized by forces within the range of its permanent cohesive force and elasticity.

AMERICAN PATENTS.

List of American Patents which issued in the month of October, 1844, with Remarks and Exemplifications. By Charles M. Keller, Examiner of Patents.

1. For a machine for making *Bricks from Untempered Clay;* Benj. H. Brown, Philadelphia, Pennsylvania, October 3.

The clay, as it is taken from the bank, is deposited in a hopper by elevators, and from the hopper it passes between two rollers, that move with different velocities, by which it is drawn through in thin cakes, and thrown on to a set of permanent teeth, and there cut up by the action of sets of teeth on a roller that work between the permanent teeth. It is then conducted by a spout into a movable mould, which, when filled, slides under a piston, actuated by a cam, to be compressed and formed into a brick, which is then discharged by a follower, actuated by another cam that forms the bed of the mould.

Claim.—"I do not claim the use of the cams for operating the pistons in pressing brick, nor do I claim the manner in which the bricks are received, compressed, and delivered; but what I do claim as my invention, and which I desire to secure by letters patent, is the arrangement of the two cams for effecting the pressure and delivery of the bricks, in combination with the pistons and movable mould.

I also claim the combination of the rollers and pins for pulverizing the clay as above described."

2. For a mode of *Marking and Lettering Packages;* Wm. Francis, and Wm. Johnson, Waynesville, Haywood county, North Carolina, October 3.

The patentees say—"The nature of our invention consists in running a composition of glue or molasses (with other materials if deemed necessary to elasticity and preservation) into moulds of letters, figures and devices, &c., formed on lines, upon which (while in a warm state) is applied thin slats of wood, or other substance, of the width of the lines, with beveled edges, which adhering to, is drawn with the composition from the moulds; when said composition becomes properly cooled, the moulds being previously oiled, these slats, when cut or separated between the letters, form type. The type when made are placed in the order required on a hand press formed of bars of wood or other material, with wire or other springs placed at regular distances fastened on said bars, on the top or surface of which said springs. are attached small blocks of wood, or other material, forming a smooth level surface, on which are placed the type, and fastened by means of slides, or otherwise, the springs admitting the type and blocks on which the type are placed, to play in a groove formed in the bars of the press, for the purpose of giving way when the face of the type touches an uneven surface, or until the whole surface of the type, and that of the package or article marked, come in complete contact with each other."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the hand press constructed as herein described, and, in combination therewith, type formed of an elastic substance. composed of glue and molasses, or other material when deemed necessary; to be used by means of said presses, with the aid of springs or other similar means, and other fixtures, as herein described, so as to insure the successful application of the type to even or eneven surfaces, using for that purpose any material or compound that will produce the intended effect."

3. For an improved apparatus for *Separating Liquids by Centrifugal force from Sugar and other Substances;* Joseph Hurd, Shoreham, Middlesex county, Massachusetts, October 3.

Claim.—"My invention, and that which I claim as an improvement, consists in the employment, in the manner set forth, of a cylinder, or other proper shaped vessel, capable of receiving and holding a mass of sugar, or other material, and whose sides are composed of a porous material of such strength and character as will retain the mass of sugar, or other substance to be operated on, and at the same time permit the passage of the liquid matters (proceeding from the mass) through them, when the said vessel is put in such rapid revolution as to generate in the liquid, or liquids, a sufficient degree of centrifugal force to expel it, or them, from the mass as described. And in combination with a vessel so arranged and operated, I claim the cistern, wholly or partially surrounding the same, or so connected with the same as to catch and retain, or suffer to escape into a proper receptable, the liquid matters as they are expelled from the mass in the vessel, and I further claim the combination with the vessel, of a means of supplying water or other cleansing liquid to the central or other suitable part of the mass of sugar, or other material to be cleansed, for the purpose of dressing, or cleansing, &c., as set forth. Also the manner of dressing or cleansing sugar, or other matters susceptible of being so dressed or cleansed, viz: by passing a current of water, or other suitable cleansing liquid, into the interior of the mass, and from thence driving it through and out of the mass by centrifugal force, substantially as explained."

4. For an improvement in *Friction Matches;* Elisha Smith, Erving, Franklin county, Massachusetts, October 3.

The patentee says—"I do not claim the combining with phosphorus, or other inflammable substance, an earthy incombustible material mixed with it, or made by means of a glutinous substance (such as glue or gum arabic) to adhere to and surround and protect it from oxidation, or the absorption of moisture; neither do I claim the employment of glue, or a gelatinous liquid or substance, for the purpose of cementing the phosphorus and protecting material together; because I believe that such earthy and gelatinous materials, whether together, or separate from each other, have long been employed both in this and foreign countries for such purpose. But that which I do claim consists in the employment, in the manufacture of friction matches, of *combustible* materials, such as pulverized dried bark, wood, or other *vegetable* matters substantially the same in character, instead of mineral and other substances, for the purpose of protecting the phosphorus or inflammable substance, and for giving consistency or body to the paste, as above set forth. And, particularly, I claim the using of vegetable matters (such as hemlock bark, oak bark, sumach, nut-galls, &c.) containing more or less tannin, and which, when combined with the glue or gelatinous adhesive mixture, form "*tanno gelatin*," or an insoluble substance, which, although almost, if not entirely proo against the absorption of moisture, will readily be consumed by fir —the whole being substantially as hereinbefore explained."

5. For an improvement in the *Life Preserver;* Adoniram Chandler. New York city, N. Y., October 3.

This is for an improvement on the life preserver patented to Jos. Francis, as assignee of C. A. De Liancourt, on the 10th of May, 1844. and noticed in the present volume, page 51, to which the reader is referred.

It is alleged that the Liancourt life preserver is liable to collapse, in consequence of the elliptical form of its transverse section, to avoid which, under the present patent, it is composed of two helical springs placed and connected together side by side.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the uniting of two helical springs, in the manner described, for the purpose of distending the air-bag of a life preserver, essentially in the manner described herein."

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6. For improvements in the machine for *Cutting and Crushing Corn Fodder;* Rudolph Miller, York, York county, Pennsylvania, October 3.

The cutting part of this machine is similar to a straw cutter with the knives attached diagonally to two heads on a shaft, the fodder being fed up by fluted rollers. The cut pieces pass from the cutting part to a roller armed with teeth which pass between similar teeth in a concave, and are thus crushed.

Claim.—"Having thus described the manner in which I construct my machine for cutting and crushing corn fodder, and shown the operation thereof, what I claim therein as new, and desire to secure by letters patent, is the manner in which I have arranged and combined the cutting, and the crushing, or rubbing, apparatus, substantially as set forth."

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7. For an improvement in the machine for *Boring Timber;* Thomas J. Russell, Franklin Square, Columbiana county, Ohio, October 3.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the combination of the racks *b*, bars *c*, screw *g*, and hooks *h*, for holding the portable frame, containing the boring tool firmly down upon the article to be bored, in the manner set forth, for boring holes at any required angle with facility and accuracy."

At each end of the machine there is a bar provided with two racks that pass through mortises in the lower sills of the frame of the boring machine, which are provided with springs and dogs to catch in the rack teeth. A screw with a crank handle passes through each sill and swivels in the bar, by means of which the frame of the machine can be elevated and depressed when the bars rest on the timber to be bored, and by means of the racks, any inclination can be given to the frame. In addition to the bars and their appendages there are pendent hooks jointed to the frame, which extend under the timber, so that by turning the screws which elevate the frame, the timber is griped between the bars and the hooks.

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8. For a *Gathering Hook, for gathering in grass, weeds, &c., in the operation of ploughing, to be covered by the earth;* Dudley Hill, East Hartford, Hartford county, Connecticut, October 7.

This is a curved hook, attached to the coulter or beam of a plough, that runs in the opposite furrow and drags all the weeds, grass, &c. which are covered by the earth thrown up by the mould-board that follows.

Claim.—"I do not claim as my invention the coulter connected with the hook; but what I do claim as my invention, and desire to secure by letters patent, is the "gathering hook," as described and contemplated in this specification, applied to ploughs for gathering in grain, grass, weeds, &c., to turn them under the sod in ploughing."

9. For an improvement in *Bedsteads;* Isaac Cooper, Johnstown, Cambria county, Pennsylvania, October 7.

This is for an arrangement of springs to distend the sacking, which is attached to four rods placed above, and connected with the rails of the bedstead by springs.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the combination and arrangement of the springs and rods with the sacking bottom and rails, as before described."

10. For an improvement in *Saddle-trees;* Samuel Ringgold, Major U. S. A., Fort McHenry, Baltimore county, Maryland, October 7.

The pommel and the cantle of this saddle-tree are each made of two pieces let into, and lapped over each other at the curved part, and extending down to the side bars, which rest on the ribs of the horse, and are separated from each other sufficiently to leave the vertebræ free and untouched. The pommel and cantle are braced by metallic arch pieces riveted to the outer faces, where the pieces of which they are formed lap. The side bars extend back of the cantle, and are there covered by metal plates bent up, and also secured to the cantle. In the claim, the side bars are designated by the letters A A, the pieces forming the cantle by the letters B B, those forming the pommel by the letters C C, the arch pieces by the letters D D, and the metal covering of the extension of the side bars by the letter V.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of the pommel, by the union of two pieces for the formation of the arch of the pommel, and the construction of the cantle by the union of two pieces for the formation of the arch of the cantle; and the combination of the several constituent parts of the saddle-tree in union with each other, in the manner described in the foregoing specification.

"I claim, also, the combination of the parts A A, B B, C C, D D, and V, of the saddle-tree, in the manner substantially the same as set forth—that is, in such manner as to give to the rider the position and ease as herein set forth; the same giving comfort to the horse, and to the saddle a marked character, by which this saddle may be easily distinguished from all others known."

11. For an improvement in the *Nursing Apparatus and Breast-Shield;* Eugene Dudley, New York city, N. Y., October 7.

This improvement consists in making the mouth piece, which enters the infant's mouth, of ivory, rendered flexible by eliminating from the bony material the carbonate and phosphate of lime in the manner well known in the arts.

Claim.—"Having thus fully described my invention, I proceed to point out those parts which I deem novel and of new effect. What I claim as new, and desire to secure by letters patent, is the application of flexible ivory, substantially in the modes, and for the use and purposes set forth."

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12. For an improvement in the *Lamp for burning Camphine or Turpentine;* Christopher West, Baltimore, Maryland, October 7.

Two rings are put on the wick tube, one at the bottom, and the other within $\frac{1}{16}$th of an inch from the top. These rings are equal in thickness, and form a space for the reception of the usual cloth conductor, over which the wick is put, and the space between the wick and the tube above the upper ring forms a receptacle for catching the gum, &c., arising, as it is said, from the burning of camphine or turpentine."

Claim.—"What I claim as my invention, and which I wish to secure by letters patent, consists in the combination of the rings, with the tubes, in the manner and for the purpose above specified."

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13. For a machine for *Cutting India Rubber into threads or strips suitable for the manufacture of corrugated India rubber goods;* Henry G. Tyer, and John Helm, New Brunswick, Middlesex county, New Jersey, October 9.

Claim.—"What we do claim in the above described machine, and desire to secure by letters patent, is the use of a series of circular knives running with great speed in water, in connexion with a small grooved roller, each knife working without friction in its separate groove, both turning in the same direction, but with unequal speed—say the knives to the rollers as 100 to 1.

We also claim and desire to secure the use, in connexion with this machine, of another small and smooth roller for the purpose of pressing the sheet in its passage evenly and uniformly on the grooved roller, thereby preventing the clogging of the material, and without which the machine would not be so efficient in action; whereby we cut and divide a sheet of rubber of any desirable length into separate threads perfectly and effectually, without injury to the strength and elasticity of the material; the whole operating substantially as above set forth"

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14. For an improvement in the machine for *Cutting Bread;* Franklin Roys, Berlin, Hartford county, Connecticut, October 9.

This is a modification of the knife used in the shops for cutting chewing tobacco, one end of which is jointed to a standard and the other guided by sliding in a slot in another standard. The improvement in question is for giving to the knife a drawing cut, by making an elongated hole in the jointed end, which slides on a pin, and having a brace jointed to the back of the knife and the standard—the handle end being guided in the usual manner.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the stud, with the slit to guide the knife perpendicularly, the brace applied to the knife to give the drawing stroke or cut, and the slit in the end of the knife.

15. For an improvement in the apparatus employed in the process of *Extracting and Rendering Lard, Tallow, and Oil from Concrete substances, and for refining the same;* Ebenezer Wilson, Cincinnati, Ohio, October 9.

The material from which the lard, tallow, &c. is to be rendered, is put, bones and all, into a large vertical cylindrical vessel provided with a safety-valve, mall-hole, &c. A perforated steam pipe from a steam boiler is coiled on the bottom, and about six inches above this there is a perforated false bottom, on which the material to be rendered lies to protect the steam pipe and give free egress to the steam. In the middle, the false and real bottoms are perforated with a hole of sufficient capacity for the discharge of the refuse matter; and around this hole the two bottoms are connected with a tube, to the upper end of which a valve is ground perfectly tight, the valve being provided with a rod extending up through a stuffing box at the top of the tank, to afford the means of opening and closing the valve, and downwards, and provided with a screw at the lower end which takes into a nut to fasten and hold it down. The tank is also provided with a try-cock near the top, and six or more other cocks, placed at equal distances apart from near the false bottom to about the middle of the height, for drawing off the rendered lard, &c., the apertures to these cocks being protected by a strainer.

After the tank has been charged, steam of very high pressure is to be admitted for a sufficient length of time to extract all the lard, tallow, &c., after which it is drawn off, and the refuse discharged through the hole by removing the valve.

Claim.—"Having fully described the nature of the apparatus which I use, and of the process which I follow, for the rendering of concrete fatty substances, I do hereby declare that I do not make any claim to the rendering of such substances by the introduction of steam into open vessels, in which they are contained—this having been previously done; but what I do claim as constituting my improvement, and desire to secure by letters patent, is the manner set forth of arranging and combining the respective parts of such a vessel: that is to say, I claim in combination the vertical tank, perforated false bottom, and discharging hole—such hole having a cover, to be operated upon in the manner and for the purpose set forth; the said tank being also furnished with a series of cocks, guarded on the interior by a strainer; the whole being so formed and arranged as to attain the proposed end, by means substantially the same with that herein fully made known."

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16. For a *Wool Combing Machine;* Ezra Gould, Paterson, Passaic county, New Jersey, October 9.

In this machine combs are arranged on radial bars attached to the face of a disk-wheel, in such manner as to be parallel with the face of the disk, and at right angles with the radial bars from which they project; and these, in combing, act in conjunction with teeth or combs, radiating from the rim of another wheel, and also carry the fibres around, to receive the action of rotating brushes.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is arranging the combs, pins, card teeth, or brushes, in rows, radiating from a common centre, and parallel (or nearly so) with the face of a wheel, when attached to the wheel, or to arms projecting from a wheel, or to a plane corresponding to the face of a wheel, or when they are attached to arms simply projecting from a shaft, as herein described. And the employment of a comb, brush, &c., thus constructed, in combination with combs on another wheel, for the purpose and in the manner substantially as described."

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17. For an improvement in the *Coupling and Stuffing Box for shafts, specially intended for submerged propellers for Ships;* R. F. Loper, Philadelphia, Pennsylvania, October 9.

The outer tube of the stuffing box, instead of being permanent, is tapped into a metallic casing surrounding it so as to admit of screwing it over the lapped or other joint of the shaft, so that when this tube is drawn in, the two shafts can be separated, and if desired, the propeller drawn up out of the water, and when screwed out, passes over and prevents the two shafts from being separated.

Claim.—"Having thus fully described my improvements, what I claim therein, and what I desire to secure by letters patent, is the before described mode of employing the cylindrical tube for the double purpose of a coupling box and stuffing box, by combining it with the coupled shaft and with the other portions of the stuffing box: by which arrangement much room is saved, and great simplicity attained —all as herein described."

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18. For an improvement in the mode of *Setting Logs on the carriages of saw mills;* John B. Squire, Liberty Township, Crawford county, Ohio, October 9.

The slides on the head and tail blocks, to which the dogs for securing the log are attached, are provided with a toothed rack operated by a hand on one arm of a toggle joint, the other arm being jointed to its appropriate block, which is also provided with what the patentee terms a "driver," one end of which bears against the joint of the toggle, and the other projects beyond the face of the block sufficiently far to strike against a rest on the floor of the mill, when the carriage is run back, to force the slide the distance required for the setting of the log.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of moving the slides of the head and tail blocks simultaneously, as the carriage is gigged back, by means of the toggle-joints, combined with the slides to which the log is dogged, and the drivers for operating the toggle-joints in the manner and operated in the way above described for setting both ends of the log simultaneously, whilst the saw is in the groove of the head block."

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19. For an improvement in the machine for *Stretching the threads, or strips of India-Rubber, and covering the same with cloth in the*

manufacture of India-Rubber Shurred Goods; Horace H. Day Jersey city, New Jersey, October 12.

The patentee says—"The nature of my invention consists, in combining with rollers constructed with elastic surfaces, certain drums and other appurtenances with elastic surfaces for stretching threads of india rubber to any given desired length, and the covering of said threads with india rubber cloth on both sides.

Claim.—"I do not intend to confine myself to any particular number of ruddles, combs, or friction rollers, intending to use as many such as may be necessary to do the work in the most advantageous way. Nor do I limit my claim to any particular contrivance by which to produce unequal speed between the friction and compressing rollers, using any such as will answer the purpose.

"I do not claim the invention of compressing or calender rollers, or the gearing with which they are driven; the same having been in common use in the manufacture of India-rubber, and for other purposes. I do not claim the rollers on which the cloth which is to cover the threads is beamed up or rolled, the same having been in common use in India-rubber and other factories. Nor do I claim the drums, or cog wheels, or bevel wheels, as new in themselves. I do not claim that part of the side frame in immediate contact with the table, and in which the compressing rollers revolve—such part being in common use in India-rubber and other factories. What I now do claim as my invention, and desire to secure by letters patent in the above described machine, is the combining with two compressing rollers, one or more friction drums or rollers, covered with suitable friction material, and combining with these the roller, together with the spool, an elastic band or apron to which the threads of India-rubber are attached. The whole being connected and working together in manner substantially as above set forth and made known."

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20. For an improvement in the machine for *Cutting Tallow and other articles;* Zabria Ellis, Kensington, Philadelphia county, Pennsylvania, October 12.

On a shaft there is a series of circular knives placed at given distances apart, and on another shaft, parallel thereto, there are angular knives placed at such distances apart as to correspond with, and play between the circular knives, and these two shafts are geared together so as to cause the circular knives to rotate with greater velocity than the angular ones. Scrapers are also placed between the knives composing the two sets to scrape off substances cut by them.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the circular and angular knives, as described; and also, in combination with the same, the scrapers, operating in the manner and for the purposes above set forth."

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21. For improvements in the machine or apparatus for *Shaping, &c., Hats made of Leather and other substances, and retaining them in shape whilst wet;* Randal Fish, New York, N. Y., Oct. 12.

Claim.—"Having thus fully described the nature of the machinery used by me for forming hats and caps of leather, skins, or other fabric, and shown the manner in which the same operates, I do hereby declare that I do not claim either of the parts taken individually; but what I do claim as my invention, and desire to secure by letters patent, is making the spring clamp band conical, that the hat may be sized whilst the band is on; and I also claim this band provided with a screw, or other adjustable clamp, in combination with the bed provided with a groove in which the band lies, and from which it can be withdrawn with the hat whilst clamped around it, as described.

"I also claim the combination of the hoop with the adjustable band for clamping the brim of the hat, to hold it whilst under the operation of the machine, and after it has been removed to admit of sizing, which could not be effected with clamp plates."

22. For an improvement in the *Straw Cutter;* E. Taylor, Rochester, Monroe county, New York, October 12.

Claim.—"I am aware that a shaving or sliding cut has been given to the knife, by attaching each end to a connecting pendulous arm, in the manner of a parallel rule; and therefore I wish it to be understood that I do not claim this as my invention. But what I do claim as my invention, and desire to secure by letters patent, is the arrangement of the hand lever in combination with the knife, so arranged as to give a parallel sliding or shaving cut, and with the apparatus for feeding the straw, one arm of the hand lever constituting one of the parallel or pendulous arms of the knife, and another arm being provided with a segment mitre-wheel to operate the feeding apparatus as described."

23. For an improvement in the *Bureau Bedstead;* Henry W. Kingman, New York city, New York, October 12.

Claim.—"I do not claim to have invented any of the parts herein shown, when taken by themselves; but what I do claim, and desire to secure by letters patent, is the making an article similar to a bureau or other piece of furniture, in the exterior appearance, and fitting the same to open in the parts *b*, *g*, *h*, *i*, and *d*, and legs 1 and 2, so as to attain the means of converting the article into a compact bedstead with great convenience, and at a moderate cost, with the several parts constructed and operating substantially as described."

The piece of furniture resembling a bureau is divided into two parts, the back indicated in the claim by the letter *b*, and the front indicated by the letter *g*,—these are hinged to the pedestal of the bureau and fall back and front, the top of the bureau being attached to the back and constituting, when opened, the head of the bedstead.—The part designated by letter *i* resembles a drawer, but conceals the front legs *h*, to support the front when let down. The legs for the back, are jointed to the back and to a rod 2, which is also jointed to the pedestal in such manner as to throw out the legs when the back is let down, and fold them when thrown up. And the part designated by the letter *d*, is that part of the bottom of the bed which covers the pedestal when the bedstead is opened—it is jointed to the front and lays over on to the back, or vice versa; or it may be made in two, jointed to the pedestal, and laid over on to the front and back.

24. For an improvement in *Lamps for burning volatile ingredients*; Isaiah Jennings, New York city, New York, October 12.

In this lamp the ingredients are placed in a reservoir above the burner and connected with it by a pipe provided with a stop cock like gas burners. The horizontal part of the pipe, between the burner and stop cock, is filled with cotton cloth through which the volatile ingredients have to percolate when the stop cock is open. The horizontal part of the pipe ends in a bulb, from which rises the vertical part of the tube of the burner, and that is filled with a roll of cotton cloth.

The burner has the following peculiarity in its form—"The apertures which constitute the jets for the flame, open into a groove, on the outside; the use of which is to protect the issuing vapor from the action of the ascending current of air always produced by the heat from combustion; this ascending current, when it strikes the gas or vapor, immediately at its issue, has a disturbing influence on the flame, which is effectually corrected by the groove."

Claim.—"Having thus fully described the nature of my improvements in the lamp for burning volatile ingredients, what I claim therein as new, and desire to secure by letters patent, is the manner of regulating the supply by the combined operation of the filling with cotton cloth, or other similar fibrous substance, in the parts designated, together with the packing of wire interposed, and the termination of the supply opening in a cylindrical stopper of straight wire immediately below the burner, as described. I claim, likewise, the employment of the groove in the burner, made in the manner and for the purpose set forth. I do not claim either of the individual parts of the packing embraced in the first claim, but limit my claim to their combination with each other, substantially as set forth."

25. For an improvement in the *Winnowing Machine for Cleaning Grain;* Calvin O. Guernsey, Russia, Herkimer county, New York, October 12.

There is a lever, for agitating the sieves, connected with them near the upper end, its lower end being connected with the frame by a joint link, and its upper end jointed to the lower end of another lever which has its upper end jointed to an arm of the hopper bottom, that passes through a horizontal slot in the frame. This last lever is jointed to a crank, so that by this connexion of parts, the hopper bottom is agitated horizontally, and the sieves receive an elliptical motion.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode here described, of agitating the sieves by the use of the lever, and the hopper bottom by the use of the other lever,—both being attached to, and moved by the crank, the upper sieve partaking of the rotary motion of the crank, and the lower sieve having a horizontal motion only; the whole being so arranged as to expose the falling grain or seed to a current of air, from the time it falls from the hopper till it reaches the screen."

26. For an improved method of *Supporting the Spine of the Human Body;* Lyman Whiton, Troy, Rensselaer county, New York, October 12.

The braces that pass around the arms are designated in the claim by the letter F, these are attached to a piece B which is horizontally elastic and placed between the shoulders. A vertically elastic piece A, connects the piece B with another horizontally elastic piece C, to which the belt is attached, and from this latter piece, on each side, an elastic brace E, connects with each of the arm braces.

Claim.—"The upper or top piece I do not claim, nor the middle or centre piece horizontally elastic, nor the brace F; but I do claim the connecting of said top piece B, and said brace F with said horizontally elastic bottom piece C, and said middle piece A, elastic up and down, and down the back, and said elastic braces E E, operating as aforesaid, whether the supporter be made of india-rubber, or any other elastic material."

27. For an improved *Air and Water Heater, for Steam Boilers;* Zenas C. Robbins, St. Louis, Missouri, October 16

This is for an arrangement of concentric tubes, forming three concentric departments. The waste steam, passing through the middle one, heats the supply of water on its passage through another of these departments to the boiler, and also the air for the blast, which passes through the third, on its way to the grate.

Claim.—"What I claim as new herein, and desire to secure by letters patent, is the combination and arrangement of the air, water, and steam chambers of my improved combined heater, in such a manner that the waste steam from a steam engine shall heat the supply water while passing through the heater on its way to the boiler furnishing said engine with steam; and the air required for combustion in the furnace of said boiler, in its passage through another portion of my improved combined heater, as herein described."

28. For an improvement in the machine for *Sweeping Streets;* Alexander M. Wilson, Rossville, Richmond county, New York, October 16.

This machine consists of a set of curved brooms, that are moved around a shaft horizontally, and carry the dirt to one side of the street, and then rise up an inclined plane to deposit it in winrows.

Claim.—"Having thus fully described the nature of my improvements on the machine for sweeping streets, what I claim therein as new, and desire to secure by letters patent, is the manner in which I have formed and arranged the brooms, and combined them with the other parts of the apparatus, their stocks or heads being curved in the manner set forth, and the system of brooms being made to revolve horizontally, and to deposit the dirt in regular rows, by raising them in a part of their circuit, as described; the general arrangement and operation of the respective parts of the machine being substantially the same with that herein fully made known."

29. For improvements in the machine for *Knitting by Power;* Pierre Emanuel Ladrange, Vignory, France, October 16th; to run fourteen years from the 1st of June, 1843, the date of the French Patent.

This is for an entirely new arrangement of the mechanism around a central shaft, so that the machinery weaves or knits an entire circle without seam. The thread is carried continuously around, and the stitches or loops are formed one after another, in succession, around the entire circle.

Claim.—"Having now described the invention, and the manner of carrying the same into effect, it is scarcely necessary to point out to any one acquainted with the construction of machines, that the form and construction of this machine admit of considerable variation, and many of the operations may be performed by other mechanical devices; I therefore do not confine myself to the precise arrangement and construction of parts herein shown, nor do I claim the exclusive use of the several parts, except as hereinafter mentioned, unless the said several parts be used in the construction and working of a machine, as hereinbefore described, for producing knitted work or fabrics. But I do claim, 1stly, arranging the hook-billed needles, such as are used in the formation of stocking-net, and all other fabrics netted radially around a circular plate, or disk, or ring, as herein described; 2dly, I claim the sinkers in combination with the comb plate, provided with radial slots through which the sinks pass, and by which they are guided, as herein described; 3dly, I claim the disk in combination with the needles for closing the beaks of the needles preparatory to casting off the old loops over the points of the needles, as described; 4thly, I claim the arrangement of the cam pieces, to throw out the sinkers; and, in combination with these, I claim the pressing pieces and helical springs for forcing back the sinkers, as herein described; 5thly, I claim the method of working the sinkers up and down in the circles, by means of the undulating rib or rail in combination with the sinkers; 6thly, I also claim the combination together of all the elements enumerated in the foregoing claims, whereby I am enabled to knit continuously around a circle, as described."

30. For a method of *Directing the Course of Aerostats or Balloons;* Muzio Muzzio, Bologna, Italy, October 16th, 1844; to run fourteen years from the 12th of May, 1842, the date of Letters Patent granted in France.

Claim.—"Having thus fully described the manner in which I construct and operate my balloon, or äerostat, I will remark, that I am aware that inclined planes have been applied to äerial machines for the purpose of enabling them to ascend by the resistance of the air;

it having been attempted to propel such machines by flapping instruments called wings, by revolving screws, by paddles, and by other similar means. I am also aware that machines thus attempted to be propelled have been furnished with jointed inclined planes, for the purpose of guiding them, in the manner of the tail of a bird; it is to be understood, therefore, that I do not claim as of my invention the mere application of inclined planes for the decomposition or resolution of the ascending and descending forces. But what I do claim as my invention, and desire to secure by letters patent, is the combination of inclined planes, substantially as herein described, with an äerial machine, or balloon, which is made to ascend and descend by a change in its specific gravity, as set forth; the ascending and descending forces decomposed or neutralized, and resolved into a horizontal one, or rather into a progressive line more or less inclined to the horizon, by the aid of atmospheric resistance; whereby the whole machine is impelled forward, and the direction changed at pleasure, by altering the inclination of the planes; the same being effected substantially as herein described. But it is to be distinctly understood that I do not limit my claim to the number or to the form of the inclined planes, or to the particular manner of operating them, or to the manner of obtaining an ascending and descending force, so long as the same is effected by a change of the specific gravity of the balloon, which, it will be evident, may be effected by the generation of hydrogen, as well as by its discharge."

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31. For an improved *Surgical Instrument called the "Uterinator;"* Daniel Gale, Boston, Massachusetts, October 16.

"This instrument is to be employed in the cure of chlorosis, amenorrhœa, menorrhagia difficulties, and in many uterine diseases; its object being to assist the surgeon in the introduction into the uterus of such injections as are generally used in the cure of such irregularities or disorders." It consists of a tube of silver, or other suitable metal, about nine inches in length, and in many respects resembling the instrument called a 'catheter.' One end of the said tube is rounded and pierced with small holes, and terminates in a small knob or button, and the other end is bell mouthed.

Claim.—"I do not claim the employment of a metallic or flexible tube in the operations necessary in uterine affections; but what I do claim, is my improved instrument, having a knob at one end, and an expanded mouth-piece at the other end, or being constructed without the said mouth-piece, but in other respects substantially as described —the same being for the purposes as hereinbefore specified."

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32. For an improvement in *Spinning Machinery;* Francis McCully, Jr., Paterson, Passaic county, New Jersey, October 19.

This improvement is fully expressed in the following—

Claim.—"What I claim as my invention and improvement, and desire to secure by letters patent, is giving to the bobbins the required rotary and traversing motion as herein described, by causing them to rest on the peripheries of wheels arranged on a horizontal traversing shaft, whether applied to the cap frame, live spindle throttle, or other modes of spinning substantially the same, in which the bobbins receive rotating and traversing motions."

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33. For an improvement in the *Valves of Steam Engines;* Frederick Ellsworth Sickels, New York city, N. Y., October 19.

Claim.—"What I claim therein as new, and desire to secure by letters patent, is— 1st. My improvement in the periods of the movements of the valves, by which they are opened and closed relatively to each other, and to the movement of the piston; by means of which, the piston completes each stroke in equilibrio, or nearly so, without admitting steam against the movement of the piston, by a lead to the steam valve, which is effected, as before stated, by opening the lower exhaust-valve before the end of the upward stroke of the piston, and before the upper exhaust-valve is closed, and opening the upper exhaust-valve before the end of the downward stroke of the piston, and before the lower exhaust-valve is closed; the movement of the steam valves being so regulated as to admit steam to the cylinder only after the exhaust-valve on the corresponding end of the cylinder has been closed.

"I also claim as my next improvement, and as a means of carrying into effect my first and essential improvement, the arrangement of the toes on the rock-shaft, in such manner relatively to the location and form of the feet on the lifting rods, that at the middle, or nearly so, of the rocking motion of the rock-shaft, both lifting rods, with their exhaust-valves, shall be partly up, as herein described; and I also claim, in combination with this arrangement, the slip of the lifters on the steam-valve stems, as described, to insure the closing of the exhaust-valves before the opening of the steam-valves on the corresponding ends of the cylinder, as herein described."

Without drawings, the above improvements could not be more clearly pointed out than they are in the claim.

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34. For an improvement in the machine for *Harvesting Wheat and other kinds of small Grain;* George Esterly, Heart Prairie, Walworth county, Wisconsin, October 22.

This is for an improvement in that kind of machines by which the heads of the plants only are cut off, and the straw or stocks permited to remain.

The box which receives the grain is supported on wheels, and is provided with a permanent knife in front, and a rotating reel with beaters which carry the heads of grain up against the permanent knife to cut them off. This reel is set in motion by a belt at each end that passes around a wheel on the carrying wheels of the machine, it being deemed important to have the reel of such length as to require a belt at each end, and as this would occasion difficulty in turning the machine, the reel is made in two parts, the shaft of one half being tubular to receive the solid shaft of the other. The axle-tree of the supporting wheels works in adjustable boxes connected with the body of the machine so as to enable the operator to adjust the machine to the average height of the grain to be harvested, and in addition to this arrangement the body is connected with the horse frame at the axletree, and by means of a lever connecting the two, the attendant can adjust the cutter to the varying height of the grain in the field.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of adapting the machine to different and varying heights of grain, by the combination of the adjustable boxes which connect the axle of the wheels with the receiver to which the cutters and reel are attached, in combination with the lever that connects the receiver with the horse-frame, as described.

"I also claim as my invention, and desire to secure by letters patent, making the reel in two independent parts, the shaft of one passing through the shaft of the other, so that they can turn with velocities corresponding with the velocities of the main wheels in turning curves of various degrees, as described, and removing the strain from the axle of the reel, cutters, and propelling gear, as herein set forth."

35. For an improvement in the *Current Water Wheel;* J. D. Robinson, Peori, Illinois, October 24.

The buckets are each composed of several narrow strips attached to chains hinged to a cylinder, so formed as to permit them to fold in one direction but not to go beyond a line radiating from the centre of the cylinder to which they are jointed—when acted upon by the current, these buckets are thrown open, but so soon as they begin to make back water they fold on the periphery of the cylinder and prevent undue resistance.

Claim.—"Having thus described my invention, what I claim therein, and desire to secure by letters patent, is the combination of the cylinder and buckets, constructed and arranged in the manner and for the purpose above described."

36. For improvements in the *Lathe for Turning Irregular Forms;* Edwin Tucker, Bucyrus, Crawford county, Ohio, October 24.

This is for a modification of Blanchard's well-known machine for turning irregular forms, in which the pattern and the piece of wood to be turned are put upon opposite sides of a rocking frame, and the pattern and cutter-wheel on a carriage that has but one motion from end to end. On the cutter carriage there is a rocking shaft, with a pattern wheel on one end, and a burr cutter on the other, to smooth or finish the work.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is arranging the pattern on one set of arms of a tilting or vibrating frame, and the article to be turned or formed on another set, vibrating on the same centre, and with them, as herein described; the gearing for communicating motion to the pattern and mandrel being arranged at one end of the tilting or vibrating frmae, substantially as herein described. I also claim arranging the smoothing wheel and small pattern or guide wheel, on different sets of arms vibrating together, and on the same centre, attached to the frame of, and traveling with, the reducing and main pattern wheels, as described; and this arrangement of the small smoothing and pattern wheels I claim, in combination of the pattern and article to be formed, as above described."

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37. For improvements in the *Method of Regulating the Draught of Stoves and Furnaces;* Joseph Saxton, and George Elliot, assigned to Harned & Elliot, Philadelphia, Pennsylvania, October 30.

In this stove, all the joints are made with the view to have them all air tight, as near as practicable, by luting or other known means.—The fuel is introduced through a hole in the top covered by a disk, having a flanch around it, and dipping into sand contained in an annular trough, or cup. The ash box, which is circular, is also provided with an annular cup containing sand, which, when borne up, receives a rim, or ring, surrounding the opening of the grate, and for the purpose of bearing up the ash box it rests on three circular inclined planes, which force it up when turned partially around; when let down it can be drawn out in the usual manner.

The air for feeding the fire is admitted through a small hole governed by a valve connected with a compensation bar attached to the stove. This compensation bar is composed of two metals of different expansibility, the most sensitive being placed next the stove, and the connexion between the bar and the valve is by means of a regulating screw—when the temperature is too great the bar expands, and permits the valve to close and cut off the supply of air, and when it contracts the valve is opened to admit air.

Claim.—"We do not claim the use of a compensation bar regulating the heat of the stoves; but what we do claim is the manner herein described, of combining with our stove, or any other substantially the same in principle, the compensating bar; the construction and arrangement being substantially the same as herein set forth.

"We also claim the manner of closing the draught by means of the combination of the ash-box, sand lute and inclined plane, in the manner herein set forth."

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38. For an improvement in the *Cooking Stove;* John W. Riggs, Fort Plain, Montgomery county, New York, October 30.

The main fire chamber of this stove is placed above the oven, in a manner will known to stove makers, the draught being admitted through an aperture in front, and near the top of the stove and descending to the bottom of the fire chamber, between the front plate of the stove and the front plate of the said fire chamber. This simply heats the top of the oven and such boilers as may be adapted to the top of the stove; and for the purpose of heating the front, bottom, and back of the oven there is an additional fire chamber placed in front, and on a level with the oven. The draught from this passes out from the upper part of the back, descends between the back plate of this fire chamber and the front plate of the oven, under, and then up the back of the oven to the chimney. There is a space left between the front plates of the stove and oven, to prevent overheating the front of the oven. Another object of this additional fire chamber, we are told, is to combine in one a winter and summer stove.

Claim.—"I do not claim an extra stove or fire chamber, nor the construction of my main stove; but what I do claim as my invention, and desire to secure by letters patent, is the manner in which I have combined the extra fire box with the main stove; that is, there being between the fire box and the oven, three division plates, or two flue spaces, for the purpose above described—the main stove being constructed substantially as described, viz: having a fire chamber above the oven, and the flues and dampers arranged and operating as set forth."

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39. For an improvement in the *Self Setting Saw Mill;* Nathaniel P. Stearns, Linklaen, Chenango county, N. Y., October 30.

Without drawings we could not give a clearer notion of this improvement than will be found in the following.

Claim.—"I do not claim as my invention the combination of the right-angle lever with its jointed arm, and the trip-lever operated by the inclined bar to set the log, as this has been applied to set the tail end of the log, the levers being brought back to their appropriate position for a repetition of this action by a spring; but what I do claim as my invention, and desire to secure by letters patent, is reversing this arrangement in combination with the head block for a saw-mill carriage, so that the lever is brought back for a repetition of the action by the inclined bar, and the log is set by the spring the moment the lever is relieved from the inclined bar. I also claim the combination of the cog wheel, ratchet wheel, drum and axle operated by the rack on the side of the carriage, with the dogs, springs, cords, weights. pole and bar for opening and shutting the water-gate, in the manner and for the purpose set forth."

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40. For an improvement in *Ladies' Bonnets;* Thomas Hammond, New York city, N. Y., October 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method herein described of making and forming bonnet-frames of steel or iron wire, case hardened, and so constructing it as to be purely elastic, so that when bent up to the shape of the bonnet, or flattened out, it retains its tension; also in hanging the crown by a small hinge to the back of the elastic frame; all of which is described in the specification.

List of American Patents which issued in the month of November, 1841, with Remarks and Exemplifications. By Charles M. Keller, *Examiner of Patents.*

(Continued from Page 339.)

42. For a *Machine for crushing, corning, or graining, Gunpowder;* Leonard S. Swett, Canton, Hartford county, Ct., November 16.

The cake is first reduced by being passed between two fluted rollers that discharge it on to a screen, the meshes of which admit the particles sufficiently reduced to pass through, and conduct the rest to a second set of rollers that discharge it into a bolting reel, such as heretofore used.

Claim.—"I do not claim as my invention any several separate part of this machine, nor any particular shape, or size, in its construction, or any particular materials for its construction, any further than necessary to produce the desired effect. What I claim as my improvement, and for which alone I ask a patent, is the combination of the two sets of rollers, or cylinders, with said screen and said bolting reel, substantially as described."

43. For an improvement in the mode of opening *Jaw Temples* used in weaving; Erastus Williams and Daniel L. Huntington, Norwich, New London county, Ct., November 16.

In the jaw temples heretofore used, the jaw does not begin to close until the lay runs back, but the present improvement is for so arranging a latch as to cause the jaws to close before the lay begins to run back, and thus cause them to catch the selvage of the cloth near the reed, where it is distended to its full width. To the front of the lay there is affixed a spring latch, the back of which is borne up against a regulating screw; the front part of this latch is an inclined plane, which, on the beating up of the lay, strikes against an inclined projection on the moving jaw of the temple, and opens the jaw, but at the end of the beat, this projection falls in behind the spring latch, which permits the temple to close and gripe the cloth, and on the return of the lay, the projection on the movable jaw opens the spring latch, that immediately falls back by the tension of the spring, to be prepared for the next beat of the lay.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method of opening jaw temples of looms, by means of the jointed latch, whereby the temples are permitted to close before the return of the lathe, for the purpose and in the manner substantially as described."

44. For an improvement in *Friction Boxes* for the journals of shafts; Martin C. Forrist, Foxborough, Norfolk county, Mass., November 16.

The box encloses three sets of rollers, which bear on the periphery of the journal and the inner periphery of the box. These rollers are placed all around the journal, and act as truck rollers, and each set is one-third the length of the box. The two outside sets are connected together by small rods or rollers that pass freely through an aperture in each, and lie between, and separate, the rollers of the inner or middle set, which is also provided, in like manner, with small rods or rollers that pass through each one and project at each end sufficiently far to lie between and separate the rollers of the two outer sets.

Claim.—"I claim as my invention, arranging three sets of friction rollers about the journal of a shaft, or between the exterior of the journal and the interior of the box; and separating said rollers from each other by means of small rolls or rollers, having loose bearings in each of the two outer sets, the whole being constructed and operating substantially in the manner and for the purpose set forth."

45. For improvements in the *Machine for Cutting Files;* Levi Anderson, Kensington, Philadelphia county, Pa., November 16.

The chisel or cutter is on the end of an arm so connected with its shaft as to be free to turn, that the cutting edge of the cutter may adapt itself to the face of the file; and for the purpose of lifting this chisel, a band passes around the arm and is hooked to a "hand" or lever operated by the tappet wheel. The striker is forced down by springs, the tension of which is regulated by a bar that slides on top of them, and the motion of the bar corresponds with the form of the file.

Claim.—"What I claim, is the manner of regulating the force of the blow by means of the varying length of the springs which bear upon the hammers, such variation in length being produced by the sliding bar, under an arrangement of parts substantially the same with that herein described. I also claim the manner of lifting the chisels by means of a band attached to the hand and arm in combination with the striker, as set forth."

46. For improvements in *Chucks for Turning Lathes;* Sidney S. Hogle, Rushville, Ontario county, N. Y., November 16.

This, in common with the well-known universal chuck, has four sliding gripe pieces, which slide towards and from the centre of the plate in radial grooves, but instead of having one screw for each, there are two shafts crossing one another at right angles, there being a right and a left-handed screw on each, so that by the turning of each shaft, two gripes are made to approach towards or recede from each other, and thus the article to be chucked is griped by two instead of four operations. For the purpose of increasing the capacity of the chuck, separate griping pieces are put on to those above named, the latter fitting in a mortise in the former, and the two secured together by a screw.

And with the view to adapt this chuck to very thin articles, a gauge-plate is provided, which has small rods projecting from the back of it and sliding in holes made for that purpose in the face plate of the chuck, so that by means of screws, the gauge-plate can be secured at any desired distance from the ends of the gripes.

Claim.—"What I claim, is the manner of combining a right and left-handed screw on the same shaft, with two sliding pieces, so as to bring them up, and to hold firmly against any article which is to be turned or otherwise operated upon in the lathe. I also claim the manner of combining with the sliding pieces, what I have denominated gripes, clips, or holding pieces, by means of which, a chuck of small size may be made to receive and hold an article of any dimensions within the capacity of the lathe to which the chuck is fitted. I claim, also, the manner of combining the gauge with the chuck, so as to adapt it to the convenient holding of articles of various thicknesses, substantially in the manner set forth."

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47. For improvements in *Machinery employed in the manufacture of Elliptical Springs;* Wm. T. Richards, Poultney, Rutland county, Vt., November 16.

This is for forming by machinery the sockets required upon the ends of the upper springs to receive the lower springs, to form the joints.

Claim.—"What I claim, is the method described of forming the sockets of elliptical springs, by placing them upon the form and acting upon them by means of the shears for the purpose, and in the manner substantially as described. I also claim the clamp and gauge in combination with the form, for the purpose and in the manner described. And I further claim the shears in combination with the stocks, constructed and operating substantially as described, whereby the shears can be moved out of the way to enable the operator to get at the form."

The plate intended for a spring is secured to a bed, or form, by means of a clamp screw, and then shears are brought up from each side to trim the circular ends. The shears are attached to sliding stocks, one on each side of the form, and they are forced towards each other by two levers, operated by a treadle and toggle joint, and forced back by a weighted lever. The stocks that carry the shears work on journals below the line of the shears, so that they can be thrown back as well as slide lengthwise, to enable the workman to get at the form.

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48. For a *Machine for Mincing Blubber* on board of ships engaged in the whale fishery; George Kilburn and John J. Kilburn, Fall River, Bristol county, Mass., November 16.

This machine consists of a wheel, one face of which is at right angles with the shaft, and the other beveled towards the periphery. To the straight face of this wheel, a curved knife is attached, which extends from a little beyond the periphery to about midway between the periphery and the centre, and back of this knife the wheel is pierced with a beveled opening. The blubber is fed up to the cutter in a hopper, the bottom of which is a little below the range of the outer extremity of the knife, so that each slice that is cut, is not entirely severed from the mass.

Claim.—"We do not claim the knife on the wheel, or the opening in the face of the wheel, nor the beveled edge of the wheel, as these have long since been known and used separately, as also the hopper; but what we do claim as our invention, and desire to secure by letters patent, is making the back face of the wheel beveled towards the periphery, and the beveled opening through which the blubber passes after it has been cut, in combination with the curved knife, and these thus combined in combination with the arrangement of the hopper, so that the part cut shall not be entirely severed from the mass in the hopper, substantially as specified.

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49. For an improvement in the *Washing Machine;* Leonard Proctor, Fultonville, Glen county, N. Y., November 16.

The clothes to be washed are put between cloths attached to one end of a tub, and passing over a roller at the other, and between these two points they are operated upon by two rollers attached to a vibrating frame. These rollers are pressed together by springs, to make pressure on the clothes as they vibrate from end to end, and this is increased by causing the clothes to pass over one of the rollers and under the other.

Claim.—" What I claim, is the combination of the elastic springs with the rollers, double cloth and vibrating frame, as applied to the washing of clothes and other articles of domestic use, by means of which, (viz: the springs) the rollers are allowed to diverge and converge, so as to adapt themselves to the inequalities of the clothes. I do not claim the principle by which the double cloth is made to pass above one roller and beneath the other, that being no part of my invention."

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50. For an improvement in *Pumps for raising water;* Joel Farnam, Stillwater, Saratoga county, N. Y., November 16.

Claim.—" What I claim, is combining the receiving and discharging cups with each other and with the cylinder, by means of a double chamber connected by trunks with the cylinder—that is to say, connecting the pump with a chamber around the outside of the cylinder, divided by partitions, said chamber communicating with the receiving and discharging cups, and also with the cylinder at either end by two tubes or trunks formed in arms or projections cast on the under side of the cylinder, one on the solid end of the cylinder on the right of the lower partition, and the other next the end of the cylinder, closed by the screw cup, on the left of the said partition, both being for the purpose of conducting the water to and from the cylinder through chambers, at the alternate backward and forward stroke of the piston, as described."

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51. For improvements in the *Furnace for Heating Buildings:* Matthew Stewart, Jr., Philadelphia, Pa., November 16.

This furnace is provided with a central fire-chamber, and hot-air chambers surrounding it; and the first improvement claimed is for lining the interior with thin vertical plates, bent at right angles, forming spaces between said plates and the cylinder. Over the sides of these plates, towards the centre of the cylinder, are arranged a series of oblique ribs, for preventing the fuel from becoming packed in a solid mass against said plates, and also from burning out rapidly; and the plates are for preventing the same effect on the cylinder, columns of smoke and other gas being kept circulating between the plates and the other cylinder, which ascend to the chimney. The other improvement claimed is fully expressed in the claim.

Claim.—"What I claim, is, first, the construction of the furnace with the lining of thin bent plates, for the purpose and in the manner set forth; secondly, the method of constructing and combining the water vessel with the hot-air chamber, by forming it with a projection and arranging it immediately over said chamber, with the tube for conducting off the smoke passing through the opening in its centre, as described."

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52. For improvements in the *Machine for Sawing Staves;* Robert Stewart, Michigan City, Laporte county, Ia., November 25.

The patentee says—"My machine is of that kind in which the saw is made in the form of a hoop, which has teeth upon one of its edges." The improvements are fully expressed in the

Claim.—"What I claim, is, first, the manner of driving the saw by means of the strap or band on its outside, in combination with the arrangement for driving it by means of the friction wheels in the interior, as set forth; and, secondly, the manner of keeping the hoop saw up to its bearing on the back plate, or flanch of the friction wheels, by placing the shafts of the said friction wheels out of parallelism with the axis of the saw as set forth."

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53. For an improvement in the *Machine for Ginning, Burring or Cleaning Wool and Cotton;* Francis A. Calvert, Lowell, Mass., November 25.

The patentee says—"The general principle upon which this machine operates is the same with that invented and applied to the same purpose by Wm. W. Calvert and Alanson Crane; and like it, the principal difference between it and some other machines which have been heretofore employed for burring and cleaning wool and cotton, consists in substituting for the knife or guard formerly used to arrest and separate the burs, seeds, and other foreign matter from the animal or vegetable fibres to be cleaned, an apparatus which shall operate upon such fibres in a manner analogous to that of picking out such foreign matter by hand. But instead of projecting edges of a revolving fluted or channeled roller to strike against the burs and other foreign matter, as in Calvert and Crane's machine, I employ what I denominate an angular toothed guard, which is made of sheet metal, which has openings or slots between each of its teeth, into which openings or slots, the pointed wires, or teeth, of a revolving cylinder, or roller, which I denominate the intersecting toothed cylinder, or roller, passes as said cylinder is made to revolve; the intention of this combined apparatus being the same with that of the revolving fluted or channeled cylinder in Calvert and Crane's machine."

Claim.—"What I claim, is the manner in which I have constructed what I have denominated the angular toothed guard, and combined the same with the revolving intersecting toothed cylinder, the angular toothed guard lying upon the fine comb cylinder and separating the burs and other foreign matter by the action of the oblique edges of its teeth, and much foreign matter being finally beaten off by the revolving intersecting teeth of the cylinder, as set forth; the respective parts being made, adjusted, and being constructed and operating substantially in the manner described."

54. For a *Governor or Regulator for Machinery;* Louis Lizé, a citizen of France, residing in Pittsburg, Pa., November 25.

This is a substitute for the well-known centrifugal governor, or the hydraulic governor, and consists of the employment of two bellows pumps, which force air into a receiver, the upper part of which is movable and connected with the steam engine or other machine to be regulated, so that when the quantity of air forced in is too great for the capacity of the discharging aperture, it is forced up and arrests the supply of steam, if applied to a steam engine, or of water, if applied to a water wheel.

As the claim refers to and is dependent upon the drawings, we are under the necessity of omitting it.

55. For an improvement in *Shutes for directing the discharge of Water on to Water Wheels;* Ira Stanbrough, Arcadia, Wayne county, N. Y., November 25.

This improvement is applicable to the tub wheel and other wheels to which the water is applied in the same way.

Claim.—"I do not claim as my invention, the employment of a series of spouts at the bottom of the flume, for admitting water to the buckets of the wheel, nor do I claim constructing these spouts in a separate plate, constituting the bottom of the flume; but what I do claim as my invention, and for which I desire to procure letters patent, is combining a movable plate or system of spouts with the floor of the flume, which is separate, and detached from said plate or system of spouts, and having apertures for the passage of the water to the buckets of the wheel, which plate or system of spouts can be removed when necessary to take out or repair the wheel, and can again be put down in its proper place without taking up or injuring the flume or the floor thereof, and without separating the spouts from each other, as described and set forth."

56. For an improvement in *Door Latches;* James M. Hoggan, New Haven, Ct., November 25.

This is for an improvement on that kind of mortise latch in which the bolt is thrown back by turning the knobs either to the right or left, the projections or levers on the spindle being located within an opening in the body of the bolt, and acting on the back face thereof. The alleged objection to the old plan, which it is the object of the present modification to remove, is the small extent of motion given to the bolt, or if not this, the great width required to be given to the opening in the bolt to receive levers or projections on the spindle of sufficient length to give the required motion to the bolt. To remedy this defect, four cogs are made on the spindle above, two above and two below, and one above and one below in the space or opening in the bolt. The first cog above and below on the spindle are on the same plane, and act against the back face of the opening in the bolt, and the other two are on a plane further back and act on the cogs of the bolt. This arrangement of the cogs is necessary to admit of pushing back the bolt by turning the knobs in either direction, for when the upper cogs are in action, the lower cogs pass by each other, and vice versa, which would not be the case if all the cogs were on the same plane. Another improvement is for adopting the spindle to doors of various thicknesses, by tapping the spindle for the reception of the knobs, which screw on, and providing a slot at each end, instead of a hole, for the securing pin.

Claim.—"What I claim, is the formation of the rim of the bolt with cogs therein, in combination with the arrangement of cogs on the segment or half pinion, for the purpose and in the manner described. I also claim the combination of the screw attachment of the knobs and segment, or knob, with the slots in the ends of the said shaft, for the purpose of accommodating the space between the knobs to any thickness of doors, as described."

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57. For improvements in *Self-acting Rotary Temples for Looms;* Wm. Craig and John Cochrane, England, November 25.

Claim.—"We shall claim the method of constructing the self-acting rotary temple so as to have the cloth pass over and in contact with the upper surface of the wheel, instead of a plate below which the wheel was placed, as heretofore made, so that the selvage shall, in a great degree, be supported on the circular edge or junction of the faces of the flanch and wheel, by having the wheel of pins revolve on an arbor projecting from the box, as described. We do not wish to be understood as making claim simply to this mode of working a wheel on an arbor, as it is a well-known device, but to limit our claim to it when employed in temples of the above construction, and in the manner and combination set forth. We also claim the projection on the exterior of the wheel-box, formed as described, and situated immediately in rear of the front opening in its circumference, and through which opening the cloth is introduced to the wheel, the same being for the purpose of guiding the selvage, or turning it downwards at the proper angle, to be received on the points, as the wheel is revolved, in the process of weaving."

ENGLISH PATENTS.

Specification of a Patent granted to John Lionel Hood, *of the city of London, for an improved composition or mixture of metals, applicable to the manufacture of sheathing for ships and other vessels, bolts, nails, or other fastenings,—being a communication.*—[Sealed 17th February, 1844.]

This invention consists in certain mixtures of copper, zinc, and lead, with or without the addition of a small proportion of antimony, tin, or iron, and in which mixture the copper exists in various proportions, up to 50 per cent.; the object being, to produce a compound which is capable of being rolled out into sheets, suitable for the purposes to which copper sheathing has hitherto been applied; and also for forming ships' bolts, nails, and other fastenings. The addition of a third or fourth metal to the ordinary ingredients of brass, (which are copper, and zinc,) is for the purpose of altering the crystaline arrangement of the particles of the metallic compound, or brass metal, to enable the manufacturer to roll the same into sheets with a smaller proportion of copper than has hitherto been practised (by which means a much cheaper sheathing is produced than sheet copper,or the sheathing hitherto known as yellow metal,) and also to form a compound which is capable of wearing well, yet containing a sufficient proportion of copper to render the surface of the plates susceptible of oxidation at sea, and thereby poisonous, by the formation of the cupreous salts, so as to resist the attack and adhesion of barnacles and other marine animals, which would otherwise impede the rate of the ship's sailing.

The mixtures here chosen are in such proportion as to combine chemically, or in atomic ratio, taking the prime equivalent, copper, at 32, according to the authority of the late Dr. E. Turner, Professor of Chemistry at the University of London.

As an example of the requisite proportions to embody these conditions, the following compounds are given, in which the copper ranges from 40 to 50 per cent.:—

	Atoms.		per cent.
Copper	16	or	40.4
Zinc	15	"	38.0
Lead	2	"	16.5
Antimony	1	"	5.1
			100.0

	Atoms.		per cent.
Copper	16	or	41.0
Zinc	15	"	38.0
Lead	2	"	16.5
Tin	1	"	4.5
			100.0

Copper	8	or	41.4
Zinc	8	"	41.4
Lead	1	"	17.2
			100.0

Copper	12	or	44.0
Zinc	12	"	44.0
Lead	1	"	12.0
			100.0

	Atoms.		per cent.
Copper	10	or	43.0
Zinc	10	"	43.0
Lead	1	"	14.0
			100.0

Copper	8	or	43.8
Zinc	7	"	38.3
Lead	1	"	17.9
			100.0

Copper	32	or	45.5
Zinc	30	"	42.5
Lead	2	"	9.0
Antimony	1	"	3.0
			100.0

Copper	10	or	46.0
Zinc	5	"	24.0
Lead	2	"	30.0
			100.0

Copper	5	or	49.0
Zinc	2	"	19.5
Lead	1	"	31.5
			100.0

	Atoms.		per cent.
Copper	14	or	44.8
Zinc	14	"	44.8
Lead	1	"	10.4
			100.0

Copper	16	or	45.4
Zinc	16	"	45.4
Lead	1	"	9.2
			100.0

Copper	32	or	46.5
Zinc	32	"	46.5
Lead	1	"	4.7
Tin	1	"	2.3
			100.0

Copper	8	or	46.0
Zinc	6	"	35.0
Lead	1	"	19.0
			100.0

Copper	8	or	49.0
Zinc	5	"	32.0
Lead	1	"	19.0
			100.0

Iron may also be employed, by forming a mixture in which 1 atom or 28 parts of the pure metal, are combined with any given number of atoms (or equivalents) of copper, the zinc being also employed in atomic ratio.

The foregoing mixtures are given merely as examples for the formation of metallic compounds, of different densities, to be employed in the construction of rods, bolts, nails, sheets, and other similar articles. suitable for marine and other purposes; but the patentee does not confine himself thereto, so long as the mixture is in definite proportions, atomic ratio, or chemical equivalents, and forming a compound in which the copper ranges in proportion, not exceeding 50 per cent. by weight; such proportions forming an economical and useful mixture for the manufacture of marine sheathing, rods, bolts, nails, and other fastenings, the same not having been hitherto used and employed for such purposes.

The best mode of manufacturing is,—first to melt the copper in any suitable furnace, and, when completely fused, to add the zinc, lead, and other metals (if others are employed,) in small quantities at a time, so as to avoid "setting" or cooling down the copper below the point of fusion; waiting a sufficient time between each addition to allow the proportion last added to become properly melted and incorporated, and taking care to prevent, as much as possible, the loss of the zinc by volatilization; which object is usually effected by holding each plate, or ingot, of zinc down below the surface of the copper, by means of a wooden pole or iron tool, till it is completely melted, as is well known to the workmen employed in making brass and yellow metal.

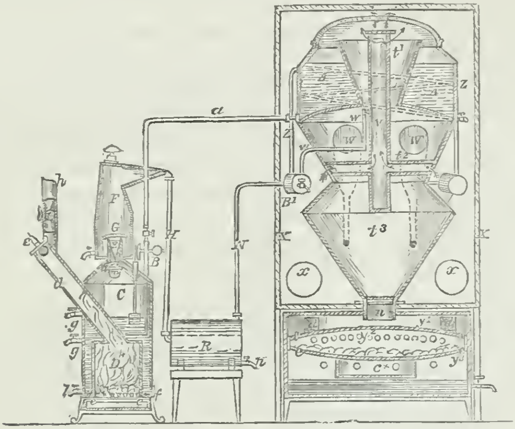
Or the entire quantity of copper may be first melted, and the lead, or other metal, then added. When the mixture is sufficiently fluid, a wooden pole should be introduced into the melted metal, and the mixture stirred well, the pole being allowed to burn, so as to liberate the hydrogenous gases from the wood, similar to the modes generally adopted in "poling" copper, when refining that metal. A portion of charcoal may likewise be thrown on the surface of the melted metal, to prevent loss by oxidation; the same being regulated by the practical experience of the founder, who should be well acquainted with the usual modes of refining copper and other metals. When this is done, the zinc or spelter should be added, in the way previously pointed out, to avoid chilling the metal too much; and when the whole is properly fused, the charge should be "tapped" or "laded" out of the furnace without delay, into iron or other suitable moulds, to form plates of from one to two inches in thickness, which should be allowed to get cold, and then separated from the moulds, and brought to a red heat, in a suitable furnace. The plates must be then passed between the rolling cylinders to reduce them to the required thickness—stopping the rolling as the metal chills below the point of redness; and reheating it as often as it is found necessary; or the plates when reduced to about ⅛th inch thickness may be rolled cold,—taking the usual precaution of annealing them in the furnace after every two or three times passing between the cylinders.

The furnaces and machinery may be suchas those ordinarily employed in melting and rolling copper and brass, which are well known, and therefore require no particular description.

The patentee does not confine himself to the precise proportions herein set forth; but he claims the manufacturing of sheathing, rods, bolts, nails, and other fastenings, for marine and other purposes, from mixtures of the above-mentioned metals, in atomic ratio, in which the copper does not exceed the proportion of 50 per cent., as above described.—[Enrolled August, 1841.] Lond. Journ. Arts & Sciences.

Extract from the Specification of a Patent granted to Charles Clark, *of the city of London, for his invention of an improved pyro-hydro-pneumatic apparatus, or means of generating, purifying, and condensing steam and other vapours.*—[Sealed 31st January, 1843.]

This improved apparatus is shewn in the annexed figure as applicable to converting sea-water, or any other water holding saline and other solid matters in solution, into fresh water. A, is the supply cistern, which communicates by a pipe *a*, with a self-regulating induction apparatus B, on what is known as "Hamer's plan." C, is a strong wrought-iron cylinder, fitted at bottom into a flanched ring-plate *c*, and covered with a conical top; it is about two-thirds filled with the water to be operated upon. D, is a cylindrical furnace, concentric with the water cylinder C; *d*, is an upward air and water-tight tube, which serves both as a feed-pipe, through which the fuel is supplied to the furnace, and as a passage for the escape of the smoke and other gaseous products of combustion; *e*, is a hinged trap-door, through which the fuel is passed into the tube *d*; *h*, is a chimney, in which the pipe *d*, terminates; and *i*, a damper, by which the degree of activity given to the furnace can be regulated at pleasure; *f*, is an open air-pipe, which leads from the outside, through the boiler, into the furnace, a little way above the fire-bars, and assists in securing a good draught through the furnace to the chimney. To the water cylinder C, there are attached gauge-cocks *g*, *g*, for ascertaining, from time to time, the height of the water; *l*, is a cock or tap, for drawing off the brine and other residual matters, which collect at the bottom of the boiler; *m*, is a screw-tap hand-hole, through which access may be had to the interior of the water-cylinder C, when it is required to be cleaned; E, is a short pipe fitted into the conical top of the water-cylinder C, and conveys the steam, generated in that cylinder, into the steam-head or receiver F; G, is a concave plate, resting upon the top of the pipe E, and is a little larger than the pipe, but is kept steady by a weight *k*, of one, two, or more pounds, (as may be found expedient) suspended from it by wires. The purpose of the plate or cap G, is to prevent, in a great measure, if not entirely, any water from escaping into the steam head; (producing the injurious effect commonly called priming) because, until the steam has acquired a pressure exceeding that of the counterweight *k*, it cannot raise the cap G, so as to escape freely into



the steam-head F; because any watery particles which may remain still intermixed with it, must, in the interval, or during the rising of the cap G, strike against it, and drop back, either into the water-cylinder C, through the pipe E, or into the space around that pipe at the bottom of the steam-head F; from which latter place, it may be withdrawn by the cock shewn in the drawing;—H, is a pipe, which conveys the steam from the steam-head F, to the rectifier R. The rectifier R, into which the steam passes from the water-cylinder C, consists simply of a cylinder, about one-third the size of the cylinder C, set in a horizontal position. In the lower part of this cylinder a body of water speedily collects, from a partial condensation of the steam, on its first admission; and the water, thus produced, serves afterwards to attract and retain any particles of undecomposed matter, which may come over with the steam, which continues to flow in from the boiler; so that the purer portions, only, of the steam may pass off from the rectifier R, by the pipe N. *n*, is a cock or tap, at the bottom of the cylinder R, for drawing off, occasionally, the water which accumulates therein; R^1, is a second steam rectifier, similar in constructon to R, into which the steam passes from the pipe N, and is thereby still further purified.

In some cases, where the quantity of saline and other matters, held in solution, is comparatively small, this second rectifier may be dispensed with; or, in others, where the water is more than commonly brackish or foul, a third or fourth rectifier, on the same plan, may be added. The condenser, for liquifying the purified steam, and aerating the resulting water, is shewn at t^1, t^2, t^3, and is composed of conical chambers or compartments, placed perpendicularly, and communicating with each other; the chamber t^1, is surrounded by the water in the cistern A, (which becomes partially heated by the steam in the chamber t^1,) and the chambers t^2, t^3, the two latter of which are exposed to the external air. The lowest chamber t^3, terminates at bottom in a tube *u*, containing, at the mouth of the cone, two or three plates of perforated zinc, through which the external air is admitted. A steam and water-tight perpendicular tube *v*, (of zinc, or other equally pure metal) is inserted at about the middle of the lowest chamber t^3, and continued to the top of the uppermost chamber t^1, and has two lateral branches. The lower end of this tube is closed; but at the top, as also at the ends of the lateral branches, it is open, for the absorption of air by the heat in the tube, and the consequent accelerated escape of the heated air at the top of the tube. W, W, are pipes, which pass externally from about the middle of the chamber t^2, to near the bottom of the chamber t^3, and at the top are of the large size represented in the drawings, but diminish gradually to pipes of a very small diameter at bottom. Of these pipes, there should be as many as can be conveniently applied, in order that the process of condensation may be effectually promoted.

From the second rectifier R^1, the steam is conveyed by a pipe *w*, of gradually enlarged dimensions, to near the top of the middle chamber t^2, whence it diffuses itself throughout the three chambers, and becomes condensed by the various cooling influences to which it is there exposed. The hottest steam of course finds its way into the chamber t^1, where it encounters the greatest amount of heat absorbing means which the apparatus furnishes for the purpose of condensation. The main body of the water, resulting from the condensed steam, either drops directly down to the bottom of the chamber t^3, or runs down the inclined sides of the chambers t^1, t^2, and t^3 and through the external pipes w, w, and out at the bottom tube, being partially aerated in its course, so far, by the air constantly ascending through the tube u.

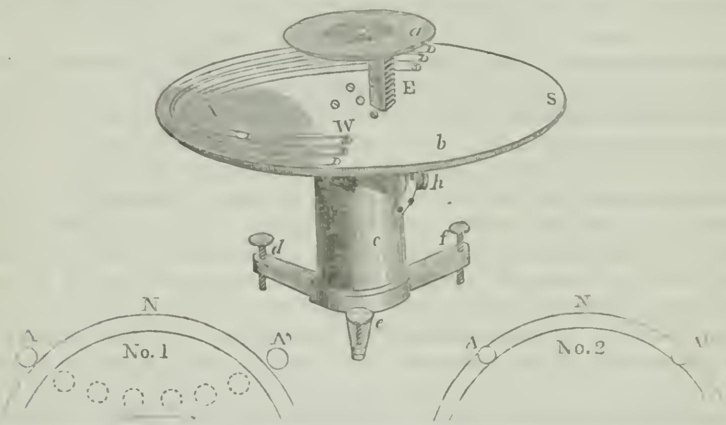
When an apparatus, constructed as above described, does not give a sufficiently abundant or rapid yield, its efficacy may be increased, by carrying an auxiliary steam-pipe z, z, from the rectifier R^1, round the outside of the water supply-cistern A, and in close contact therewith, for one, two, or more coils, terminating in a cylinder which communicates, by pipes, with the chambers t^2, and t^3, so that all the water, resulting from the steam condensed therein, may be precipitated through the perforated zinc plates into the general discharge tube u. x, is an outer casing of wood or metal, which encloses the condenser,—a small space in width being left all round, and draft-holes x, x, made in different parts for the admission of air. The refrigerator is made of protected metal, and divided into three compartments y^1, y^2, and y^3. In the top of the compartment y^1, is inserted the end of the discharge-tube u; and at a little distance from this tube there are air apertures a^*, a^*, which have shutters on the inside, slanting from the top downwards, to prevent, as much as possible, the escape, outwards, of any vapor which may occasionally be carried down with the water from the condenser. The middle compartment y^2, which is pierced with air-holes all round, is of a convex form at top, and of a concave form (inside) at bottom; so that the water, which drops from the tube u, on to the centre of the convex top surface of y^2, falls off towards the sides, through small pipes, which admit the water into the interior of the compartment y^2; while, on the other hand, the concave form (inside) of the bottom of that compartment, causes the water, when it arrives there, to flow towards the centre, where there is a filtering-box c^*, which projects a little way downwards into the lower compartment y^3, placed to receive it. For the purpose of breaking up the water, and thereby the better aerating it, the bottom of the compartment y^2, is covered, about an inch deep, with small pebbles, through which the water percolates towards the filter. The lower compartment y^3, which serves for the final reservoir of the purified and cooled water, is perforated with air-holes.—c^1, c^1, are small pipes, which serve to promote the continual flow upwards of external air. The compartment y^3, is furnished with a tap, by which the water is drawn off, as required.* Ibid.

* The remainder of this Patent is for Modifications for Rectifying Spirituous Liquids, and Extracting the soluble portions of vegetable substances.—Com. Pub.

The Orthochronograph.

[Registered under the Act for the Protection of Articles of Utility.]

At a late meeting of the British Association, Dr. Robinson exhibited and explained the Orthochronograph, an ingenious instrument recently introduced by Messrs. Webster & Son, the eminent chronometer manufacturers, of Cornhill, London. The Orthochronograph effectually accomplishes the object in view, the ascertaining of correct time. Its property is derived from the intersection of a curvilinear line at two points by the circular transit of a solar ray. The instrument consists of two horizontal circular plates, parallel to each other. The upper one, *a*, has an aperture for the passage of a solar ray; the lower one, *b*, has three pair of semicircular lines, for the purpose of making observations. The lower plate, *b*, is supported by a pillar, *c*, resting on a tripod, furnished with three adjusting screws, *d*, *e*, *f*. The upper plate *a* is raised or lowered by means of a rack *g*, working out of the pillar *c*, by means of a pinion and friction rollers, acted upon by the milled head *h*.



For taking an observation, place the instrument upon any firm support, with the letters N and S as nearly north and south as may be; but rigid accuracy in this respect is by no means essential. By means of a spirit level and the adjusting screws *d e f*, bring the plate *b* into a horizontal position; then raise or lower the plate *a*, until the sun's ray is in contact with the line on which it is intended to make the observation, as at A in the diagram, No. 1, or until the ray appears within the double line as at A, No. 2. In either case note the hour, minute, and second, when the ray is at A; leaving the instrument undisturbed the sun's ray will traverse the plate in the direction of the arrow until it arrives at the point A′, when the time is again to be accurately noted. Add the results of the two observations together, and divide by 2; the difference between this result and 12 hours will show the error of the clock as compared with solar time, which being corrected by the necessary equations (of which very complete tables are given in the descriptive pamphlet which accompanies the instrument) gives the desired result. For example an observation is taken outside the line, (No. 1,) on the 21st December, 1843.

	h.	m.	s.
1st Observation A,	8	58	15
2nd do. A′,	14	52	24*
	2)23	50	39
	11	55	19
	12	0	0
	0	4	41 too slow.
Equation of time,	0	1	51 slow.
Clock really too slow,	0	2	50

The interval between the two observations will depend on the time when the first is made; it is better not to be less than three hours; the first observation, therefore, should not be later than ½ past 10 a. m.

The Orthochronograph is at once cheap, portable, and simple in its construction and use, not liable to be deranged, and may be used in any part of the world by the most unpractised hand; while the result of the observation requires only the operation of addition or subtraction to give true time.

To country clergymen, watchmakers, and persons having the care of public clocks, such an instrument is almost indispensable; to the lover of mechanics or the mathematician it will afford the pleasure which always arises from a new application of natural phenomena to practical purposes; while the mariner will find it serviceable, when, on making the land, he wishes to test the accuracy of his chronometer.

Lond. Mechanics' Mag.

Specification of a Patent granted to HENRY HEIGHTON, *of Rugby, for "certain Improvements in electric telegraphs."*—Granted July 10, 1844; Enrolled Jan. 10, 1845.

The object of the invention is to adapt a system of telegraphing to common or frictional electricity. For this purpose the inventor uses an Armstrong's hydro-electric or other powerful electric machine, and with it charges a Leyden battery. He employs an instrument, different modifications of which are described in the specification, and which regulates the number of discharges sent, the intervals of time at which they are sent, and the nature of the discharge, that is to say, positive or negative. He shows that in 10 discharges any one of a number of more than 16,000 signals may be made, or in 30 discharges any one of more than 1000 millions if necessary.

The method of observing the signals at the place to which they are sent is by means of two wires, the one communicating with the place from which the signals are made and the other with the earth, which are placed perpendicularly to a sheet of paper or similar substance, which is moved along by clock work, so that each discharge shall pass over the surface and through the substance of the paper, making a hole close to the wire from which the negative electricity proceeds. This paper is colored with chromate of lead, which is easily decomposed by the electric spark, and moistened, if necessary, with sulphuric acid to facilitate the passage of the spark. Thus the sparks leave on the paper a kind of printed register of the signals which have been made. Other methods of observing and registering the signals are described, where the electricity, after having traversed a great distance, is too weak to produce the effects just described.

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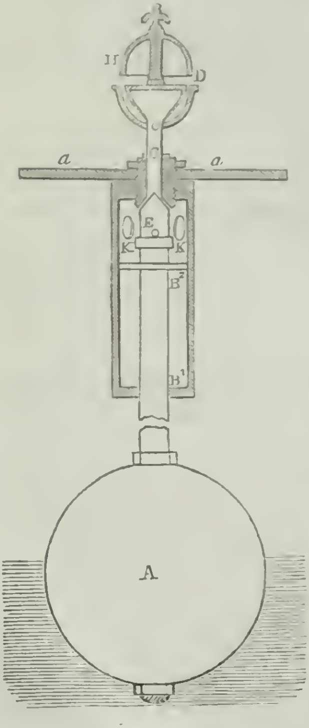
* The hours after noon are reckoned as 13, 14, 15 &c., and not as 1, 2, 3 o'clock, &c.

Civ. Eng. & Arc. Journ.

Allen's Anti-Explosive Alarm Whistle.

Registered under the Act for the Protection of Articles of Utility.—Job Allen, Engineer, Proprietor.



The object of this instrument is to prevent injury to boilers from the water falling below its proper level.

A is a float attached to a stem or rod, which passes upwards through a tube, B^1, and a diaphragm, B^2, fixed within that tube, and terminates in a conical top, which fits into the hollow pipe, C, of the steam whistle D. The lower end of the whistle D is passed through an orifice in the top of the boiler (indicated by the letters *a a*,) and screwed into the top of the tube, which is thus kept steady, if in a vertical position. E is a collar attached to the stem of the float, near the top, which, catching against the plate B^2, on the fall of the stem or rod A, prevents it from descending further. When the water falls below the safety line, and the float along with it, the descent of the stem of the float opens the pipe C of the whistle, and allows the steam to escape, which, impinging against the bell H at top, produces the alarm required. K K are orifices in the side of the tube to facilitate the rushing of the steam into the whistle, as soon as the boiler is in danger.

Lond. Mechanics' Mag.

Specification of a Patent granted to Edward John Dent, *of the Strand, London, chronometer maker, for Improvements in Ships' Compasses.*—Granted July 30, 1844; Enrolled Jan. 30, 1845.

Amongst the evils arising from the present construction of compasses are the following:—1st. The friction arising from the imperfect mode of suspension; which is that of a hollow cup in the centre of the needle, resting upon a steel point; in which case it is obvions that a want of horizontality in the card will cause considerable friction between the convex sides of the pivot and the sides of the cup. 2ndly. A considerable error is caused by the assumption, that the *magnetic axis* of the needle coincides with what is called the *maker's axis*, which is the line determined by the marks or zero points on the extremities of the needle; which error in flat needles, such as are usually applied to compass-cards, is frequently of such magnitude as to be quite inadmissable, even in compasses for common purposes, much less for those intended for accurate experiment. 3rdly. Another source of inconvenience and inaccuracy arises from the unequal amount of inertia as regards the axis, or horizontal line drawn through the centre of the card, about which line it is compelled to vibrate or deviate from its horizontal position by means of the alternate pitching and rolling of the vessel. However well the gymbal apparatus, in which the card is placed, is balanced, yet as the card has a motion or time of vibration to itself, depending upon the position of the axis of its vertical vibrations with respect to the axis of the needle—which vibrations are not altogether under the control of the gymbals although its vibrations are continually checked, and its quiescence disturbed by it in consequence of the supporting pin coming in contact with the sides of the cup, as before mentioned--yet in the construction of the binnacle compass, the card ever will be subject to irregular deviations from the horizontal plane, arising from this cause.

The mode by which the inventor has removed these evils has been by altering the nature of the suspension; that is, by suspending the card in a similar way to the balance of a chronometer, and with equal delicacy, both ends of the pivot acting on diamonds, and the holes jewelled, by which means the card is constrained to move very nearly in the horizontal plane, since in this respect it is entirely under the control of the gymbals. The friction is also considerably reduced by this mode of suspension. The great accuracy with which the card returns to the same position has been clearly shown by a great number of experiments. To remove the error arising from the nonagreement of the *marked* or *maker's* with the *magnetic axis*, a simple contrivance is effected for the *inversion of the card*, so that either side of it may be placed *above* or *below*. Since the marked axis of the needle is in each of these positions at equal distances from, but on opposite sides of the magnetic meridian, a mean of an equal number of observations in both positions of the card will evidently eliminate any error of this nature, and give the true magnetic azimuth of the observed object, *at the time of observation*, by an equal compensation of error. It it also plain that the constant adjustment required to make a delicate needle horizontal in different magnetic latitudes is rendered thus unnecessary. Lond. Civ. Eng. and Arch. Journ.

The Himalaya Funnel, for the Cure of Smoky Chimneys, Registered pursuant to Act of Parliament, 6 & 7 *Vic. c.* 65. *Sole Proprietors, James Boyd and Son,* 78, *Welbeck Street, Cavendish Square, London.*

Fig 1.

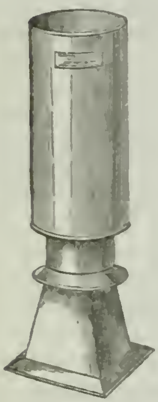
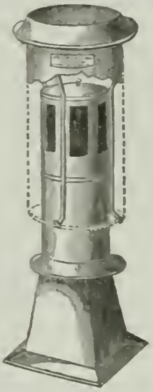


Fig 2.



The principle upon which this apparatus is constructed, is that of conducting the smoke through apertures in the sides of the chimney shaft, into an outer case of considerable length, which extends above the top of the chimney, and is open both at the top and bottom, the chimney shaft itself being perfectly closed at the top. A current of air thus passes vertically through the outer case; and, in conformity with an established law, both of pneumatics and hydraulics, that when two currents of fluid matter passing in the same direction, but in separate channels, arrive at any point of confluence, the stronger current draws along in its course, and with a considerable portion of its own velocity, the weaker current: so the force of the wind, which checks in other instances the action of a chimney draught, in this is made to produce a stronger draught exactly in proportion to the violence with which it blows. Whether the wind blows *upwards* or *downwards* through the outer case the effect is the same, as the chimney shaft is closed at the top. The Himalaya Funnel thus becomes a perfect wind guard, equally applicable for increasing the draught, whether exposed to horizontal or vertical currents of wind; and will therefore remedy the largest class of smoky chimneys, which are those arising from high winds and *downward currents,* produced by adjacent buildings of greater elevation, or by any other *external* cause; and for all such defects it must be an infallible remedy. The conical projection upon the funnel a few inches below the exterior case (see Engravings) is intended to increase the effect of horizontal currents of air, by deflecting them upwards between the funnel and the exterior case, at the same angle at which they strike upon the said projection, and thereby assist the efflux of the smoke; but no air passes into the *interior* funnel, either at the conical projection or elsewhere. And in order still further to increase the effect of horizontal currents of air, the conical projection on the top edge of the outer case (fig. 2) may also be used when required.

The Funnel may be constructed of zinc, iron, or other metals. It is extremely simple—not liable to derangement—is readily swept by the ordinary machine—effectually excludes rain—and being perfectly devoid of machinery, it possesses great advantages over all revolving chimney tops or cowls, which are liable to continual derangement by their exposure to the weather. Ibid.

MECHANICS, PHYSICS, AND CHEMISTRY.

On Elkington's Process of Coating Iron with Zinc, Copper, &c.—
By F. PELLATT.

Our present object is to detail the method of protecting iron by coating it with other metals, by means of depositing them from their solutions by an electric current. Iron, from its strength and cheapness, is perhaps the most valuable of all metals, and its application is now universal; it seems as essential to the convenience of man as air or water to his physical wants. The abundant supply of the mineral ore, in connexion with coal, the necessary agent for making it useful, has done much to raise our country to the high standard of political importance it now enjoys among nations. Valuable, however, as this metal is, it has this drawback, that it is subject to decay under almost every circumstance in which it can be placed, from its strong affinity for oxygen; and, as this agent is present in air, earth, and water, iron is ever liable to be acted upon by this destructive element.

Combining with oxygen, iron becomes what we term rusted, and so insinuating and destructive is this agent, that no sooner is one layer of oxide formed than another begins and undermines it, and so on till the iron is completely corroded.

Seeing how susceptible this metal is of deterioration and decay, it might be thought that much attention had been paid to secure some mode of protecting it, but this has not been the case, probably owing to the extreme cheapness of iron, rendering it necessary that the protecting coating should have, not only the property of indestructibility, but should not add much to the cost of the iron, otherwise it would, in many instances, be cheaper to reinstate it.

The only means of protecting iron, hitherto in use, are paint and tinning; both of these methods possess the advantage of cheapness, but not durability. Paint is very easily destroyed, especially if moisture be present, and, therefore, is not fit to protect iron for any length of time, even when exposed to the atmosphere only.

The coating with tin would be a very efficient method of protecting iron, were it not for the electrical properties of these two metals. Tin is electrically negative to iron, and, by the law of electricity, when metals are in contact, the negative metal is protected at the expense of the positive, and therefore the tin is protected whilst the iron is more readily destroyed by its contact with it; besides, when two metals are in contact, the negative is made more negative, and the positive more positive.

In proof of this, we have only to refer to the celebrated experiments of Sir H. Davy. Copper, when alone, is readily acted upon by sea-water; but in contact with zinc or iron, metals positive to it, they are destroyed, and destroyed much more quickly by their contact with the copper, whilst that metal is rendered more negative by its connexion, and consequently protected. A proof of the operation of this law of electricity may be seen every day, in the state of iron railings which have been let into stone-work with lead, a metal negative to the iron; it will always be found that the parts in contact or adjacent to the lead are much more corroded than any other part, and this from the lead being negative to the iron, and thus destroying it. It has long been known that zinc, being electrically positive to iron, would by its galvanic influence protect it; but the insuperable difficulty was the mode of applying it; for, although zinc melts at a temperature of 773°, it very readily forms an oxide at this high temperature which does not melt. Still, from the importance of the subject, some attention during the last few years has been directed to it, especially in France, and about the year 1837 a patent was taken out in that country for covering iron with zinc, or what was termed galvanising iron; in this country, a joint-stock company was formed for carrying out the process, some of the leading iron-masters being interested in it; and so great was the importance of the subject then considered, that the enormous sum of 100,000*l.* was to be given for the patent if the process succeeded. After many fruitless attempts to carry it out, it was abandoned, from the difficulty experienced in maintaining the zinc in an unaltered fluid state. This process, however, is now being carried on, and therefore it is probable that improvements have been made in conducting it. The method of operating by this process is by plunging the iron into melted zinc, whereby a certain portion combines with, and is retained upon, the surface, in the same manner that iron is tinned. Many practical as well as theoretical objections present themselves to this process, and, in a report made upon the subject to the French Academy, M. Dumas says, "The zincing of iron made by steeping iron in a bath of melted zinc has many inconveniences; besides, the iron combining with the zinc constitutes a very brittle superficial alloy, the iron loses its tenacity,—a circumstance which is not perceived, however, except in trying to zinc fine iron-wire, or very thin plate; besides, the surface, being covered with a layer of not very fusible metal, is always ill-formed. Thus fine iron-wire cannot be zinced by this process, as it becomes fragile and deformed; bullets cannot be zinced, as they become misshapen and no longer of the same calibre." In order to prove the correctness of M. Dumas' account of the tenacity of iron zinced by the hot process, we procured 18 lengths of No. 18 wire, all from one hank, 6 being zinced by the hot process, 6 by the electro process, and 6 not zinced, and submitted them to tension. The 18 inches' length of wire not zinced stretched to 22 inches; that zinced by the electro process, to 22½ inches; and that zinced by the hot process, to only 19½ inches; shewing that, whilst the hot process materially interfered with the tenacity of the wire, and entirely altered its condition, the electro process rather added to its tenacity.

The above is the mean of the results given by experiments upon six pieces of each. Another peculiar property of zinc when hot is the fact that zinc heated to 300° becomes tough and ductile, and is at that heat rolled into sheets; but above 400° it becomes brittle, and just below the melting point is so brittle that it may be pounded in a mortar like marble. Now zinc put upon iron at such a temperature has these evils: that portion which combines with the iron, for which it has a very great affinity, forms a very brittle alloy; and also that portion of zinc which adheres to this alloy, or coats it, does not possess the tenacity of ordinary zinc; besides, the contraction of hot zinc and iron being nearly as 3 to 1, the zinc being 3, the iron resists its contraction, so that the molecules of the metal have not the freedom of arranging themselves in that position necessary to ductility; for which reasons, zinc put upon iron by the hot process is brittle, and breaks by bending. Another objection is, that the zinc used in this process is not pure, not only from the presence of foreign matters required to keep the zinc in fusion, but from the impossibility, except at an enormous cost, of obtaining pure zinc; but, supposing these objections overcome, the alloy which the zinc forms with the iron at a melting heat destroys its protecting qualities. Impurities in ordinary metals tend, to a certain extent, to deteriorate their value; but impurities in zinc are its destruction, and this arises, as we have before stated, from the electro-positive qualities of zinc, and by which it protects other metals at the expense of itself.

Thus, supposing an atom of zinc to be surrounded with atoms of impurities, these, when brought into connexion and exposed to a fluid or to moisture, form a galvanic battery, the zinc being destroyed by this galvanic action, the time such destruction takes to be effected depending altogether upon the circumstances in which it is placed, whether in contact with moist air, water, or acid. This is the reason why the ordinary zinc of commerce does not last so long as might be reasonably expected from the known properties of that metal.

The hot process of zincing is also ill suited to the coating of articles of large dimensions, and all articles of minute workmanship must be necessarily injured by it, the melted zinc entering and filling up the outlines of the work. Before speaking of the electro process of zincing, we may say a few words upon the properties of zinc when in a state of purity. Dr. Kane says, "Zinc preserves the other metals, even if it be of iron, from oxidation; and again, zinc, when exposed to the air, even in presence of water, becomes covered with a varnish of a gray substance, probably a definite suboxide which is not further altered by exposure." Professor Graham, alluding to iron in water, says, "Articles of iron may be completely defended from the injury occasioned in this way by the more positive metal zinc, while the protecting metal itself wastes away slowly." And further speaking of zinc, "When exposed to air, or placed in water, its surface becomes covered with a gray film of suboxide, which does not increase; and this film is better calculated to resist both the mechanical and chemical effects of other bodies than the metal itself, and preserves it." And Professor Daniell in his last work says, "that a plate of pure zinc, when immersed in water, speedily becomes dulled by the formation of a thin coat of oxide, but the oxidation proceeds no further, because the adhesion of the metal prevents a renewed contact of the metal and the water." We therefore see that, not only has zinc the property of protecting metals galvanically negative to it, but, unlike many other metals, becomes itself protected by its own oxide. We have before alluded to the difficulty of obtaining zinc in a state of purity except at a great cost, as well as the great difficulties, when so obtained of applying it to iron; the electro process fortunately saves us all trouble on these accounts, as impurities, though they may exist in the solution used, are thrown to the bottom, the pure metal only being deposited upon the iron. In the report to the French Academy we have before noticed, M. Dumas, in speaking of the electro process for the deposition of zinc, says, "Manufacturers, and those concerned in military affairs and the fine arts, will learn with interest that these processes enable us to zinc, in an economical manner, iron, steel, and cast-iron, by means of the pile, or battery, with the solution of zinc, by operating without heat, and consequently not interfering with the tenacity of the metal, by applying it in thin layers, and by thus preserving the general forms of the pieces, and even the appearance of their minutest details. The thinnest plate may receive this preparation without becoming brittle, and may be turned to account in roofing buildings."

This process is very simple. We take ordinary crystalised sulphate of zinc, dissolving it in water, in the proportion of one pound of the sulphate to one gallon of water, which forms our zincing solution. The iron to be zinced is first thoroughly cleaned by allowing it to remain for a short time in dilute sulphuric acid, and afterwards well scoured with sand: it is then placed in the zinc solution, attached to the negative pole of the galvanic battery (plates of zinc being attached to the opposite pole which face the articles in the solution) and the deposit takes place. After being a short time in the solution, the article should be taken out and scoured or brushed all over, so that any portion which may not have been very properly cleaned, and to which the zinc has not perfectly adhered in consequence, may be discovered. It is then returned to the solution and allowed to remain therein until a covering of the required substance is obtained. The advantages of this process are its simplicity, the absence of all injurious effect upon the iron, and the securing a coating of *pure* zinc. The largest articles can with facility be zinced, and articles of the most minute and elaborate workmanship are uninjured by the process. The operation may be intrusted to any one of ordinary capacity, and, what is of some importance in large operations, may be carried on *any where*.

It is not improbable that the practical details and manipulations of this process may be improved, but, in principle, we aver it is perfect. We need not particularize the uses to which iron so protected may be applied: to all the purposes for which iron is used it would be of advantage, particularly where it is exposed out of doors. The iron-work of all agricultural implements, harness and cart-fittings, fencing and hurdling, the iron-work of hot and green-houses, latches, bolts, and hinges, brestsummers of buildings, &c., &c.; in fact, its uses are infinite, and the application of the process only requires to be known to secure its general adoption.

We shall now say a few words upon copper as a coating for iron.

Copper is another metal which may be used with great advantage to protect iron, especially for ornamental purposes. It was probably the deposit of this metal from the sulphate of copper, in Daniell's battery, which first suggested to Spencer the application of the decomposition of metallic salts by the agency of the battery. Since that period, the science of electro-deposition has been gradually developing itself, year after year adding to our knowledge, and, at the same time, shewing us how little we know of the subject in comparison with what yet remains to be discovered. Long before the discovery of deposition by an electric current, it was well known that a piece of iron or steel placed in a solution of sulphate of copper became completely covered with metallic copper; and iron has been long used for collecting the copper from water impregnated with it, both in Wales, Cornwall, and Ireland. Following up this practical result without being acquainted with the cause of copper being deposited upon iron, many were induced to follow out the process of coating iron by electricity with the sulphate of copper, and, finding that the coating thus obtained had no adhesion to the iron, considered their experience a rule, and thus originated the prejudice against coppered iron. The coating of copper received upon iron, when placed in the sulphate (or other *acid* solution) of copper, is not from any galvanic action, as many have supposed, but from a chemical substitution only; the iron having a greater affinity for the sulphuric acid of the solution, it leaves the copper for the iron, and the portion of copper thus thrown out of solution becomes loosely attached to the iron. And even the addition of a galvanic battery effects no change in the condition of the metals, the chemical action preceding the galvanic; and, although a coating may be forced on by the power of the battery, it is never in *direct* contact with the iron, but there is interposed a portion of oxide, and the copper thus deposited may be removed with the slightest friction: so that the trials made with iron so coated have failed. So strongly has the prejudice thus created operated, that we have heard it asserted, within these few days, that it was impossible to give to iron a permanent coating of copper. In March, 1840, a patent was obtained for securing perfect and permanent coatings of copper upon iron, alkaline instead of acid solutions being used. Those we have found less suited to the purpose are the cyanides and ferro-cyanides, and what we have lately adopted is the ferro-cyanide of copper dissolved in the cyanide of potassium.

After the iron has been properly cleaned it is placed in this solution, heated to about 120°, in connexion with the battery: in from two to five minutes it will be found completely coated. The iron should then be scoured with sand, and placed in an acid solution (by preference for cheapness the sulphate); if any portion of the iron should not have been coated in the alkaline solution, such part will immediately turn black, in which case it should be cleaned and returned to the alkaline solution for one or two minutes.

By this process any article of iron-work, whether cast or wrought, may be firmly coated with copper. To test the adhesion of the metals, we have had many iron bolts, of thirty inches long, driven through African oak of twenty-four inches thick, and with a very tight drift, without in the least disturbing the coating of copper; we have also heated them to a heat far above redness, and then plunged them into cold water, without any injury arising from the difference of expansion and contraction of the metals.

We are aware that an objection may be made to the use of copper as a preserving coating to iron, viz: that, the copper being the negative metal, the galvanic action is against the *iron*. We admit this; but, if the coating of copper is perfect, this cannot be the case, as no galvanic action can possibly take place unless the metals are both together exposed to the fluid. The resisting qualities of copper to oxidation, when exposed to water and vegetable acids, render it a valuable protection to iron under all ordinary circumstances.

For ornamental work copper is best adapted, as it takes a beautiful bronze, either by exposure to the atmosphere or by artificial means. A great saving might also be effected by casting statues and other ornamental work in iron, and afterwards coppering it. The iron castings of the Colebrook Dale Works cannot be surpassed for sharpness and effect.

Works of art in iron, plasters, terra cotta, wood, and other substances, may be thus made to resemble antique bronzes, and the process may be advantageously adapted to machinery, especially that which is exposed in damp situations.

We may add that iron either zinced or coppered solders with great facility.

Trans. Soc. Arts.

Advance of Iron Shipbuilding—Iron Collier.

A great deal of curiosity has been excited by the arrival in the Thames of a Newcastle collier; she is a fine-looking vessel, built of iron, and fitted with a screw propeller worked by an engine of 20-horse power; which is said to combine the advantages of several recent patents, and still different to all; it consists of four flies or flaps of peculiar construction, bending over an angle of 45 degrees from a line with the axle; she is 130 ft. long, 27 ft. 6 in. wide, and, when loaded with 340 tons of coals, her draught is only 11 ft. 9 ins. aft, and 10 ft. 3 ins. forward; her hold is divided into separate chambers, after the principle of C. W. Williams's water-tight bulkheads, and each has a hermetically closed false door, into which water can be admitted by large taps, for ballast, and when not required is pumped out again by the engine. Her bows are sharp and wedge-like, and her stern unusually projecting; though low, her counters are so flat that she lifts with every swell, and it is nearly impossible for a wave to break over her taffrail. She is called the *Q. E. D.*, and on her stern is an armorial bearing, with the motto—"*Spes mea Christus.*" From the step of the mainmast to the cap is 65 ft. and from her keel to the royal truck about 130 ft.; her mizenmast is of iron, and hollow, forming the engine chimney, and the emission of the smoke from such a situation has a very singular appearance. We understand she both sails and steers well, and the propeller has answered every expectation. She was built by her owner, Mr. Cootes, of Walker's Quay, Newcastle, and from the growing evidence of the superiority of iron for shipbuilding in lightness, strength, and economy, it is probable in a few years few will be constructed of wood, and that scarce a sailing vessel will be without a screw propeller, to have recourse to in time of need.

Mining Journ.

Machinery for Carving.

A patent having been taken out some time since for a method of carving wood and stone by machinery, a large manufactory has been established by Mr. Pratt, of Bond Street, for the purpose of working it. The uses to which it is at present principally applied are to carve elaborate foliated tracery, crockets, finials, &c., required for external and internal paneling in wood and stone for churches. The rapidity and consequent economy with which the work is effected are astonishing. We saw, on a recent visit, a small piece of trefoil paneling in stone finished in 15 minutes, which by the ordinary processes would employ a skilful workman a whole day. Nor is the rapidity of execution detrimental to the accuracy and finish of the workmanship. We carefully examined a great number of the specimens, and were satisfied that the materials were not susceptible of more perfect finish. In the crockets, finials, bosses, and other solid work, indeed, much has to be done by hand after the mechanical work is finished. The mechanism here only cuts away the larger parts, and prepares a ground for the hand of the carver. But in paneling, little or nothing is left to manual skill; all that is requisite is to retouch some of the acuter angles of the tracery.

The machinery by which these wonderful processes are effected is, like all valuable machinery, very simple. Many of our readers have probably seen the experiment, which used to be performed in the Adelaide Gallery, of cutting through the hardest steel files by a circular disk of soft iron which revolved with very great velocity. This principle of increasing the efficiency of cutting tools by making them revolve with great rapidity is utilized in the present patent. Drills of various shapes are caused by steam power to revolve rapidly in a vertical position. The extremities of the drills are serrated, and it is therefore obvious that they will rapidly cut through wood or stone when presented to them. By guiding the wood or stone in a proper manner the drills may be made to cut them into any form required.

This is the general principle. The following is the manner in which it is carried into effect for carving an oak panel. A slab of solid oak is firmly fixed to a flat table which is capable of turning on its centre. On the slab is closely screwed a templet of iron, in which apertures are cut corresponding in form with the parts to be incised in the oak. The revolving drill is supported by a radial bracket, which can swing horizontally, and can be raised or lowered as may be desired when set to work. The workman depresses the drill and brings it to bear on one of the portions of the slab which appears through the apertures of the templet; and by slightly turning either the bracket of the drill or the table, he can bring the drill to act on any part of the slab. Consequently by guiding the drill all round the edge of the aperture of the templet, he speedily cuts away the wood to an uniform depth and of the exact shape of the pattern.—The wood has now been pierced through to the requisite pattern, but the edges of the parts incised are plain and perpendicular to the sunken. These plain edges must be converted into mouldings, and for this purpose fresh drills are substituted, the templet still remaining. These drills vary in shape according to the moulding required; they are, as before, worked round the edges of the pattern, and by undercutting laterally produce the desired forms.

The invention is capable of extension to many purposes beyond those to which it is at present confined; chimney pieces, furniture of elaborate pattern, and articles of slate may be produced at a greatly diminished cost. Carved furniture and paneling which have hitherto been confined to the palace and the mansion, may by these means find place in far humbler dwellings.

The mechanism which Mr. Pratt has constructed for such important objects must be valuable in every respect; and we deem it no small part of the benefit arising from the construction of a great public work like the Palace at Westminster, that men are thereby stimulated to the discovery of such inventions as the present. We should state that the invention is due to a Mr. Irving, who attends to the working of the machinery. Mr. Pratt is now engaged in constructing a roof for Great Malvern Abbey, full of tracery, including the tie beams and spandrels; the dimensions of the roof are 90 ft. in length and 30 ft. in breadth; the cost, including the wainscot, will not be more than £1,500, and it is to be finished within eight months after the order was given. The cost of such a roof constructed by manual labour would be at least from £5000 to £6000. A piece of tracery containing 2 square feet and 2 inches thick will not cost more than 14*s*., including the oak. We must not omit to mention that Mr. Pratt has engaged Mr. Billings, well known by his works connected with Gothic Architecture, to attend to the architectural department.

We are informed that the principal part of the decorations in oak of the interior of the New Houses of Parliament is to be executed by the aid of this machinery. Civ. Eng. and Arch. Journ.

On Improvements in the Manufacture of Glass for Optical Purposes. By Mr. Claudet.

Heretofore, the manufacture of glass fit for the purpose of the optician has been a matter involving great uncertainty and difficulty, and in fact it was not until the year 1744 that it was accomplished with any degree of success. About this time, however, a Swiss named Guinand, in making some experiments in the construction of the telescope, found the extreme difficulty of procuring glass fit for lenses; the difficulty led him to endeavour to make glass for himself, and from his labours arose the first process by which glass could be made with certainty sufficiently good in quality for the construction of optical instruments. With the death of Guinand his secret was partially lost. The invention which forms the subject of Mr. Claudet's paper is founded upon the process of Guinand, and is due to a French glass manufacturer named Bontemps, whose attention was first drawn to the subject by the son of Guinand himself. The chief defect in optical glass consisted in striæ and spots; these arose from the great difficulty of properly mixing the materials when in a state of fusion; it was impossible to stir the melted mass, because the temperature was so high as to destroy the instruments of metal, and besides by introducing them into the glass it would have been tinged with color, according to the nature of the metal employed. The method used by M. Bontemps is to introduce the iron rod used in stirring into a clay cylinder closed at one end, so that the glass is entirely protected from the injurious action of the iron; the ingredients are thus effectually mingled; the glass is then suffered to cool gradually, the crucible broken with care, and the mass sawed transversely into slices, so that lenses may be obtained of the diameter of the crucible. Very large lenses have been produced by these means, and two of a metre in diameter are now in progress of manufacture for the Royal Observatory at Paris.

Trans. Soc. Arts.

Additional Remarks respecting the Condensation of Gases. By M. Faraday, Esq.

The author, suspecting the presence of nitrogen in the nitrous oxide on which he had operated, repeated his experiments with this gas very carefully prepared from pure nitrate of ammonia; but the results still indicated the presence of a more volatile gas mixed with another less volatile. He found that olefiant gas is readily soluble in strong alcohol, ether, oil of turpentine, and other bodies of the same kind; and that, like the former gas, it seems to be of a compound nature. His experiments confirm the prevalence of the law that the force of vapor increases in a geometrical ratio for equal increments of heat, commencing at a given amount of pressure. The more volatile a body is, the more rapidly does the force of its vapor increase by an augmentation of temperature; the increase of elasticity being directly as the volatility of the substance. By further and more accurate investigations, a general law may be established for deducing from only a single observation of the force of any given vapor in contact with its fluid, its elasticity at any other temperature.

Trans. Royal Soc.

Rapid Printing.

A curious instance of rapid printing has come to our knowledge, which is worth recording. The Lords of the Admiralty ordered that the Nautical Almanac for 1845 should be reprinted. The old edition of 8,500 copies had been exhausted: and, as sometimes happens with this work, copies were selling at twelve times the original price to those who absolutely required them, and had neglected to procure them. The order was given on the *fourth* of last month, and on the *twenty-fourth*, only seventeen working days having intervened, complete copies were sent to the binder. This Nautical Almanac contains 616 large octavo pages, *of which 572 are filled with numerals*, and the rest with small print. The printers, Messrs. Clowes, were (to save time) intrusted with the complete supervision, not a single sheet being sent to the Nautical Almanac Office to be compared with the old edition until it had been finally worked off. The result of careful examination at the Almanac Office, made as soon as each sheet was finally dismissed from the printers, shows a list of 33 errata, or one for every 19 pages: and most of these errata are trivial. Two of them are only wrong rules; nine of them consist in the dropping out of a letter or figure at press, which happens in the most deliberately printed works; one of them is a substitution of a word in capitals for one in Roman letters. Some people will at first imagine that the type of the first edition remained standing, and that the new edition was printed from it. But the first edition was printed *four years ago*. Truly we have here a striking instance of the power of a printing-office.

London Athenæum.

Enamel Portrait on Porcelain.

The silver Isis medal was presented to Mr. J. Haslem, for his Enamel Portrait on Porcelain.

In the large enamel portrait of the Duke of Wellington submitted to the Society, the object has been to combine the force and freedom of an oil-painting with the richness of color and brilliancy of an enamel; and the following is the way in which this was executed.

An oval wood panel was procured in the first place, and the portrait painted on it in oils. Two colors only were used for this purpose. In the lights the color was laid on thick and prominent,—in short, it was painted with a considerable *impasto.* From this painting, when it was sufficiently dry, a mould was taken in plaster of Paris; the porcelain clay was pressed into this mould, and a slab, or plate, thereby made, on the surface of which was an exact impression of the original painting on the wood panel. After the slab had been fired and glazed, it was painted with enamel colors, in the way highly finished paintings upon porcelain are usually done, *i. e.* it was first what is called "washed in," and fired in the enamel kiln, painted over again, and fired again, and so on until it was finished. For this purpose it passed through the enamel kiln five or six times.

This portrait should not be taken as a perfect specimen of a new style; it is only a *first experiment*, and by no means so perfect, as far as the impasto is concerned, as it ought to be. In making the slabs in the first instance considerable difficulty was encountered. As is often the case in making large pieces of porcelain, many were spoiled by breaking, and otherwise, before one could be got to stand the firing. By the time this was done the mould had lost a good deal of its sharpness. The slab afterwards got too thick a coat of glaze, by which the impasto suffered still further. From these two causes the impasto is not nearly so sharp as was intended; consequently the picture has lost a great deal of that *crispness* which it was anticipated one got up in this way would possess: and probably it has lost from the same cause something in *effect* also. Trans. Soc. Arts.

Electric Clocks.

The following extract from a letter from Mr. Finlaison, of Loughton Hall, appears in the *Polytechnic Review*:—"Mr. Brain has succeeded to admiration in working electric clocks by the currents of the earth. On the 28th of August he set up a small clock in my drawing-room, the pendulum of which is in the hall and both instruments in a voltaic circuit as follows:—On the N. E. side of my house, two zinc plates, a foot square, are sunk in a hole, and suspended to a wire: this is passed through the house to the pendulum first, and then the clock. On the S. E. side of the house, at a distance of about forty yards, a hole was dug four feet deep, and two sacks of common coke buried in it; among the coke another wire was secured and passed in at the drawing-room window, and joined to the former wire at the clock. The ball of the pendulum weighs nine pounds, but it was moved energetically, and has ever since continued to do so, with the self-same energy. The time is to perfection, and the cost of the motive power was only 7*s.* 6*d.* There are but three little wheels in the clock, and neither weights nor spring; so there is nothing to be wound up." London Athenæum.

On Robinson's Patent Drying Machine. By J. Robinson.

This machine was first used in the manufactories of France for the purpose of drying fabrics of wool, cotton, and linen, and was found to produce a great improvement in the color and appearance of the articles passed through it, as well as a considerable saving of labor and fuel.

It has been used with equal success in this country, as by means of the machine all kinds of scoured and dyed wool, woollen cloths, flannels, stuffs, mousselines de laine, merinos, printed cottons and silks, dyed worsted yarns, &c. &c., as well as all articles requiring bleaching (put into it quite wet,) will be sufficiently dry in six minutes to work and finish off, leaving a suppleness of texture and brilliancy of color unattainable by heat.

Trials of the machine have been made at the Royal Naval Hospitals at Haslar and Plymouth, the officers of which establishments report most favorably of it. At Haslar Hospital the result was

1st Trial.	6 Blankets 2 Flannels	wrung in 4 minutes	From the period the machine reached its velocity, and every part of the articles equally dried or wrung.
2d Trial.	9 Sheets 28 Shirts	wrung in 8 minutes	
3d Trial.	15 Blue coats 21 pairs of Stockings	wrung in 4 minutes	

From hanging up in the drying-room, thermometer 101°.

A Blanket, thoroughly dried and fit for use, in . . .	1 hour,	23 minutes.
A Sheet . . . , .		41 "
A Shirt		57 "
A Blue Coat	1 "	45 "

At Plymouth Hospital the result was—

1st Trial.	6 Blankets 15 pairs of Stockings	wrung in	6	minutes.
2d Trial.	10 Coats 10 Trowsers	"	5	"
3d Trial.	11 Sheets 20 Shirts	"	8	"

The machine consists of two boxes revolving on an axis with great rapidity, the number of revolutions when at its full velocity being at the rate of 300 per minute. It is set in motion either by cog-wheels or a strap and pulley with an ordinary handle. The boxes are inclosed in an outer case to prevent the water from flying about, through which case the air enters by means of openings at the sides and ends. Trans. Soc. Arts.

Method of Preparing Benzoic Acid. By Dr. STENHOUSE.

Proceed as in Sheele's process, by mixing finely pulverized gum-benzoin very intimately with its own weight of slacked lime, also in fine powder. The mixture is to be repeatedly boiled with water so long as any benzoate of lime is dissolved. The filtered liquid is to be evaporated to about one sixth of its bulk, and a considerable quantity of a strong solution of hypochlorite of lime is to be added to it.

The mixture, while boiling hot, is to be decomposed by a slight excess of muriatic acid, and the boiling continued till all the chlorine is driven off. On the cooling of the liquid the benzoic acid is deposited in crystals, which are but very slightly colored, the greater portion of the coloring matter having been removed by the chlorine. The crystals, however, still retain some resinous matter, from which impurity they may be readily freed by being once or twice dissolved in a very small quantity of boiling water and recrystalized. A little purified animal charcoal may also be advantageously employed for this purpose. Lond. Edin. & Dublin Philos. Mag.

On the Quantities of Rain received in gauges at unequal Elevations from the Ground. By Prof. PHILLIPS.

The author, referring to three Reports which he had already presented, observed that the results arrived at, on York Minster, on the Yorkshire Museum, and on the ground at York, for three years, appeared to require no repetition, and that the reasoning on the results having been generally accepted, he should have thought it unnecessary to recall attention to the subject, unless he had some new facts to communicate. On duly estimating the force of the objections which had been, or might have been, urged against the former experiments, such as the influence of local eddies and currents of wind about the Minster and Museum, and such buildings generally, Prof. Phillips resolved to establish a registration of gauges raised into the open air, to various heights, independent of buildings. He had carried on trials of this kind at intervals for more than five years, and after using globular gauges. and various modes of measuring the rain collected, he had finally employed for the last two years, funnel gauges, emptying themselves into reservoirs placed in the ground. Thus some particular difficulties were obviated, and a consistent tally of results obtained. In 1843, from January 9 to October 14, he had obtained registrations of the gauges almost continuously, and in 1844, a similar series from January 1 to September 2, was recorded for him by Mr. Cooke. The gauges are five in number, at 1½, 3, 6, 12, and 24 French feet above the ground. The registration for the two periods are as under:—

	1843.	1844.	Sum.
	Inches.	Inches.	Inches.
24	14.618	9.540	24.158
12	15.419	10.620	26.039
6	15.549	10.640	26.189
3	15.608	10.690	26.298
1½	15.619	10.940	26.559

On these facts the author forbore to comment, having the intention to vary the experiments.

The EARL FITZWILLIAM observed, that although the quantities collected in the several gauges differed somewhat for the two years, yet it was remarkable that the proportions were much the same.

Proc. British Assoc.—London Athenæum.

On Simultaneous Barometrical Registration in the North of England. By Prof. PHILLIPS.

Following out a limited district in the plans of contemporaneous hourly registration, which had been prosecuted by Sir J. Herschel and M. Quetelet, for larger areas, the author found the means to combine observations on the barometer, attached thermometer and direction of wind, for twenty-four hours in each month, at nine stations in the north of England: viz. Kendal, Shields, Whitby, Scarborough, Hull, York, Sheffield, Birmingham, Manchester. The observations of five of these stations for six months, had been approximately discussed, viz. those of Shields, Hull, York, Sheffield, and Birmingham, and the results projected in diagrams. They showed, 1. the remarkable *general* accordance in the forming of the contemporaneous curves at all the stations. 2. The various limits of the deviations from uniformity, never amounting at any two stations to above one-twentieth of an inch. 3. The passage of waves of greater or less pressure in directions nearly corresponding to the path of the wind at the time, and with velocities which appear proportioned to the general movement of the atmosphere at the time, viz. twenty to forty miles an hour. (The author announced a further communication on this subject in 1845.) Ibid.

Transit of Mercury.

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Burlington, Vt., May 26, 1845.

Gentlemen,—I attempted ascertaining the time of the late transit at this place as accurately as my imperfect means would allow. I ascertained the time of my watch on that day by eleven pairs of equal altitudes, corrected for the change of declination; none of which gave the time more than four or five seconds from the mean, and the greater part gave it within two seconds, although it was very windy. My telescope did not authorize me to notice the external contacts; the internal resulted as given below. I had no micrometer to estimate the diameter of the planet, or its distance from the limb.

Internal contact, beginning 11 h. 30 m. 11 s. A. M., mean time.
Do. do. ending 5 53 56 P. M., do.

Yours, respectfully, JAMES A. DEAN.

ERRATA.

Page 206,	from top	8th line, for	“make”	read	“making.”
“	“ from bottom	19th line, for	$\overline{\pi x - hn^2}$	read	$\overline{\pi x - hn}^2$
“	“ “	17th “	$(n+\overline{1+n^2 \frac{1}{2}})$	read	$(n+\overline{1+n^2}^{\frac{1}{2}})$
“	210, from top	10th line, for	1.4433	read	1.4324
“	“ “	12th “	.6369	“	.6366
“	211, “	8th “	6.04636	“	6.04369
“	“ “	13th “	.4916	“	.4416
“	“ from bottom	13th “	4.619:1.55	“	4.616:1.154
“	“ “	5th “	.186	“	.116
“	“ “	1st “	.167	“	.133

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